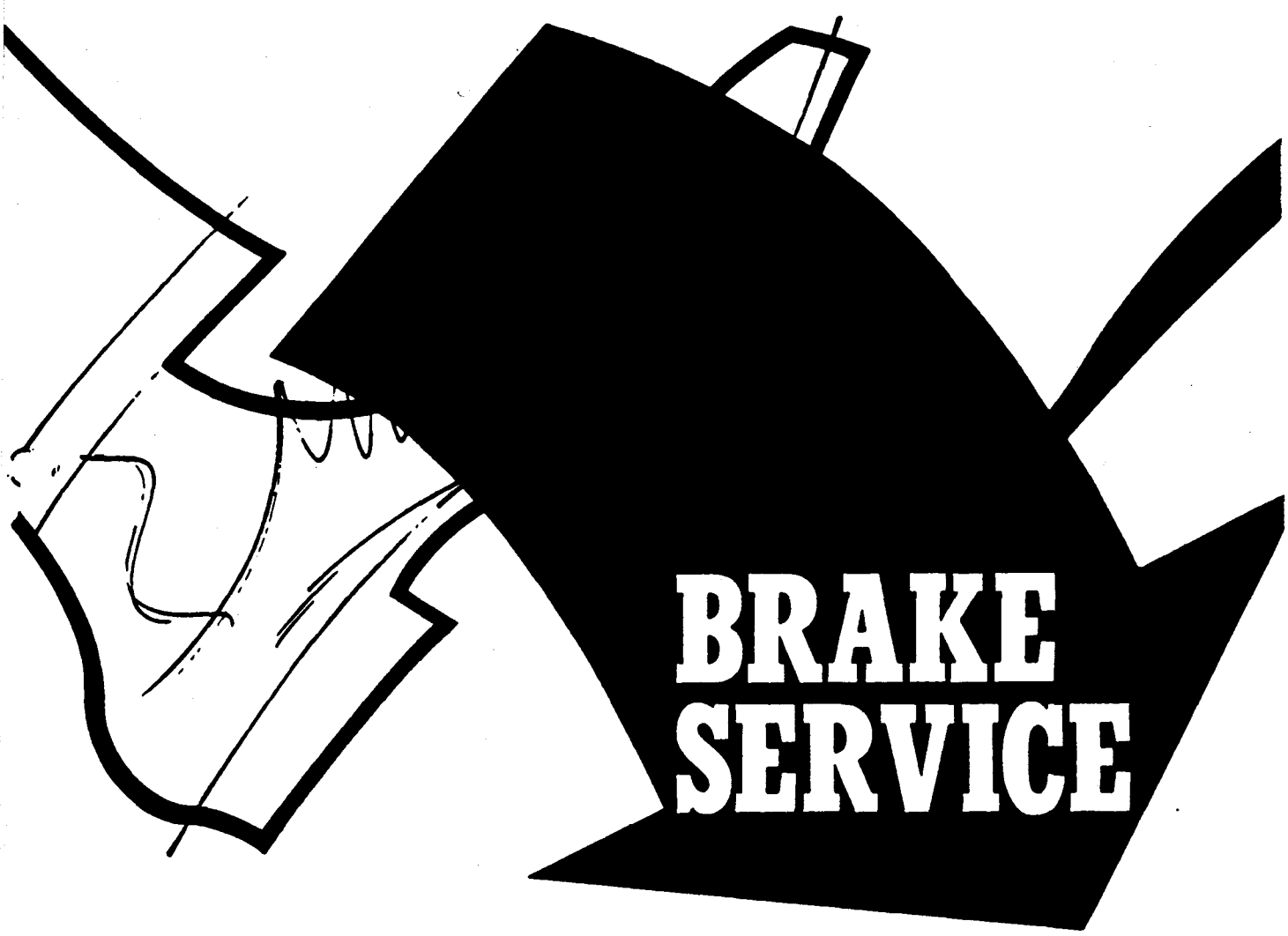


THE MASTER TECHNICIANS SERVICE REFERENCE BOOK

SESSION

64

11



BRAKE SERVICE

MASTER TECHNICIANS SERVICE CONFERENCE
PREPARED BY CHRYSLER CORPORATION
PLYMOUTH • DODGE • CHRYSLER • IMPERIAL



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CHR-263

Brake Service and Know-How

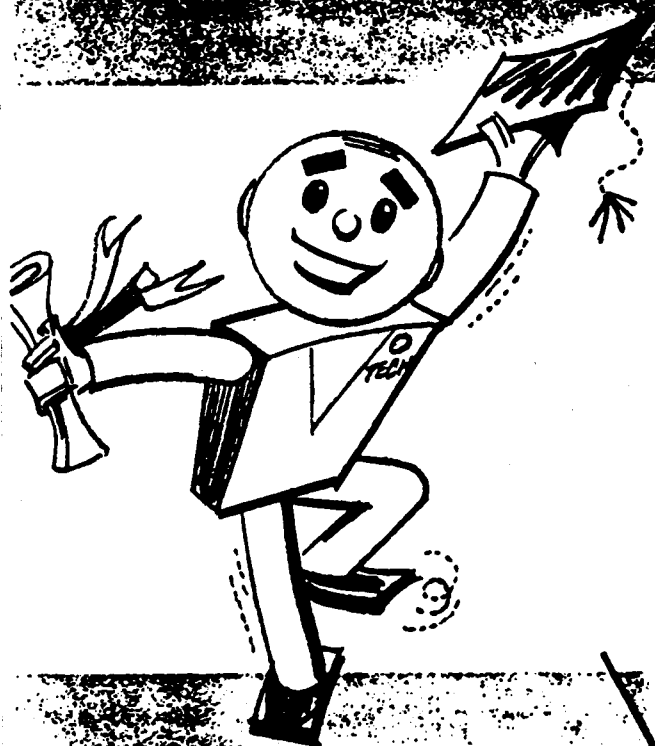


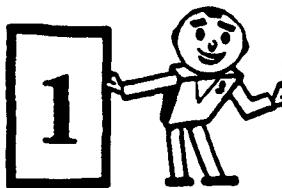
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There's a lot more to servicing brakes than making sure they stop the car when the driver steps on the brake pedal. Of course, that's the most important part of brake service—seeing that they work.

But it's also very important that the brakes work quietly, and smoothly—without grabbing, pulling or chattering. And just as a whole lot of engineering know-how goes into brake design, a whole lot of servicing know-how goes into brake service and maintenance.

An important part of brake know-how is a knowledge of fundamentals. This reference book explains how the servo contact brakes work, goes into diagnosing brake problems, and ends up with service tips and precautions. So whether you're involved in routine brake service or troubleshooting complaints, or you're just plain curious about how they work, there's good information here for you.

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HOW THEY WORK

Servo-contact brakes have a dual-piston cylinder to apply hydraulic servo force to both brake shoes. A single anchor above the cylinder serves both shoes. The shoes are connected to each other through a floating adjuster. When there's no hydraulic force at the cylinder, the shoes are held against the anchor by the return springs.

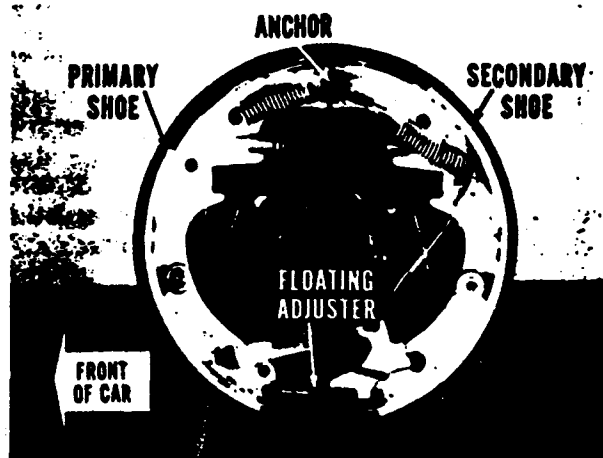


Fig. 1 — Servo-Contact Brake

SELF-ENERGIZING ACTION—CAR GOING FORWARD

When the driver steps on the brake, the wheel cylinder pistons force the shoes out against the drum. Because of friction between the lin-



Fig. 2 — Self-energizing action

ings and drum, both shoes try to revolve with the drum. This turning movement forces the secondary shoe against the anchor.

Then, the turning force on the primary shoe is transmitted through the adjuster to the bottom of the secondary shoe. This is called the self-energizing force. It pushes the secondary shoe out against the drum, using the anchor as a pivot.

SELF-ENERGIZING FORCE VS. HYDRAULIC FORCE

Hydraulic force is small compared to the self-energizing force exerted on the secondary shoe. Consequently, the secondary shoe is pushed against the drum much harder than the primary shoe is. This means the secondary shoe does most of the braking. The primary shoe's main function is to energize the secondary shoe.

PRIMARY AND SECONDARY LININGS

The primary lining is a high friction material. High friction gives it a greater tendency to turn with the drum, and therefore increases the self-energizing action. The secondary shoe, though, is made of a lower-friction, long-wearing material to carry the braking load.

Here's an important point to remember: Each lining is designed for its particular job, and each material is compounded so both will wear at approximately the same rate in normal use. Of course, everyone doesn't drive the same, and very severe brake usage often causes the secondary shoe to wear faster than the primary. *Don't* leave a used primary shoe on the car and replace only the secondary just because the primary shoe still has some lining on it.

DON'T MIX 'EM

Mixing linings or using unapproved linings can get you in all kinds of trouble. For instance, if the shoes were changed around, the primary lining would be in the secondary position and would carry most of the braking load. Since the high-friction primary lining is relatively soft, it would wear out quickly.

If two secondary linings were used on one wheel, brake performance on that wheel would be very poor. The low-friction lining wouldn't give as much self-energizing action as is needed. And if the opposite wheel had the two primary linings, the car would pull badly. Two primary linings on the same wheel would make the brakes very grabby.

BRAKE ACTION—CAR BACKING UP

When the car is backing up, the action of the brake shoes is reversed. The rear servo piston actuates the secondary shoe, which supplies self-energizing force to the primary shoe. The primary shoe then does most of the braking in reverse.

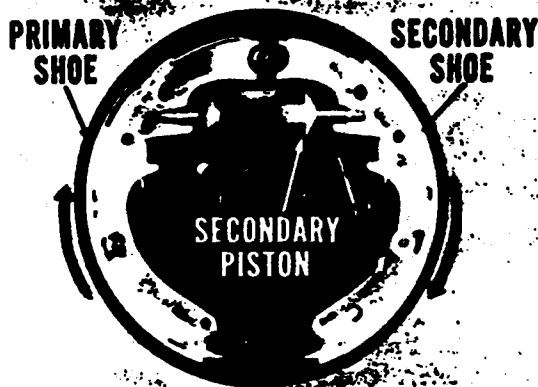


Fig. 3 — Reverse braking action

Of course, you don't get as much self-energizing force in reverse. But reverse braking requirements are considerably less than in forward braking.

AUTOMATIC ADJUSTERS

The automatic adjusters compensate for lin-

ing wear by spreading the shoes farther apart at the bottom as the lining wears. This maintains proper lining-to-drum clearance at all times. Therefore it maintains correct pedal height. Here's how the automatic adjuster works:

If the brakes are applied when the car is backing up, the secondary shoe moves away from the anchor. The adjuster cable guide mounted on the shoe web is carried downward and outward by movement of the shoe. The movement of the cable guide pulls on the adjuster cable, so it exerts a pull on the adjuster lever.

The lining-to-drum clearance established by lining wear determines how far the shoe moves, and how far the cable is pulled. If there's enough clearance to require adjustment, the cable pulls the adjuster lever far enough to engage the next notch in the star wheel. When the brakes are released, the spring-loaded adjuster lever turns the star wheel. This lengthens the adjuster, which decreases drum to lining clearance and puts the pedal at the right height.



Fig. 4 — Adjuster lever turns star wheel

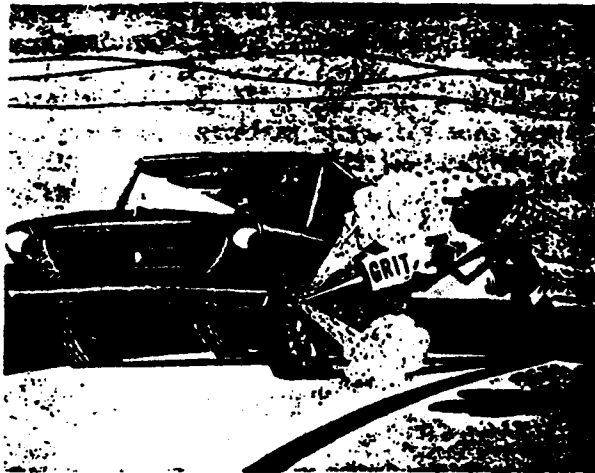


BRAKE PULL AND DRAG

Pull is simply a condition of uneven braking on opposite sides of the car. Usually, it's

caused by unequal friction in the brakes on opposite sides of the car. Thus, if the right-

hand lining grips the drum harder than the left, the car pulls to the right.



IT'S NOT ALWAYS THE BRAKES

Pull during braking doesn't necessarily mean you have brake troubles. Improper front-end alignment—particularly unequal caster—is a possible cause. Other causes are: a weak torsion bar or spring; a loose lower control arm strut; a loose wheel bearing; an underinflated tire. Make sure one of these conditions isn't causing the pull before you blame the brakes.

DIFFERENT DRUM FINISH

If the braking surfaces of drums on opposite sides of the car have different finishes—for instance, one is dull and the other highly polished—it's likely that friction will be different and cause pull. To correct this condition, rough up both drums with 60- or 80-grit emery cloth. Be sure both drums have comparable finishes when you're done.

GLAZED LINING

Occasionally, a lining becomes glazed on the surface from heat. This occurs from a dragging shoe, from improper run-in of new linings, and from prolonged riding of the brakes—for instance, using the brakes instead of the engine for downhill braking. A glaze decreases lining friction. This can cause pull, particularly if one lining is glazed more than the others.

Remove glaze by sanding with emery paper. Be sure to rough up the other linings, too, so you end up with the same lining finish on both sides of the car.

LINING CONTAMINATION

Contamination of a lining changes the friction characteristics of the lining. Sometimes it decreases braking effectiveness and at other times increases friction causing brake grab.

If the contamination is from a leak, be sure to locate the cause of the leak and repair it before you install new linings.

REPLACE CONTAMINATED LININGS

You can't save contaminated linings, so don't try. Solvents or a blowtorch may remove the surface contamination, but they'll also attack the bonding and lining material. This will change the lining friction characteristics and can cause more serious brake problems. Sanding is no good either, because it can't remove contamination that is soaked in.

If you're replacing a relatively new lining that's become contaminated, be sure to pull the opposite wheel, too. Sand all the drums and linings so you have a comparable finish on both sides.

Of course, if the lining is worn, you should replace the linings on both sides of the car.

THE UNEVEN ADJUSTMENT MYTH

Back in the days when cars had mechanical brakes, the lining-to-drum clearance adjustment had to be equal on both sides. If it wasn't, the brakes applied unevenly, and caused pull. Many people think this is still the case with hydraulic brakes, but it just isn't so.

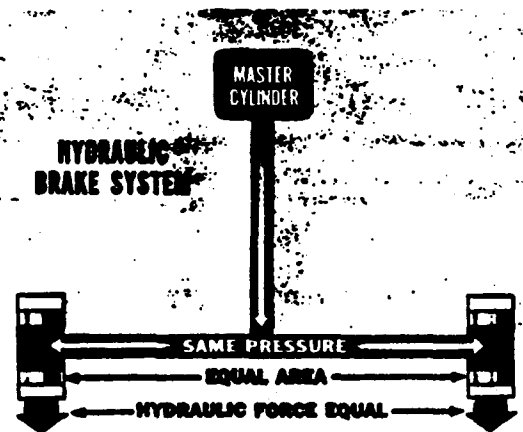


Fig. 5 — Hydraulic force is equal

Remember from Pascal's Law in Session Number 64-5 . . . "Pressure on a confined fluid . . . acts with equal force on equal areas." A hydraulic brake system is no exception. Pressure is equal at all wheel cylinders.

And since the right- and left-hand wheel cylinder pistons always have the same area, the hydraulic force available for braking is equal at the right and left sides. Remember, too, that no pressure is built up as long as one piston is moving with no resistance. So, even if one piston has to travel farther, it ends up exerting the same force on its shoe as a piston that travels a shorter distance. In other words, *all* the shoes have to be out against the drum before there's any braking at any wheel.

A PINCHED LINE CAN CAUSE INITIAL PULL

Of course, if a brake line is pinched, it can act as an orifice. The orifice effect would delay pressure application at one cylinder and delay application of the brake. Then you'd have pull on initial application, until enough fluid got past the restriction to apply the piston.

PULL ON LIGHT BRAKE APPLICATIONS

Occasionally you run into a case where the brakes pull when they are applied lightly, but not when they are applied quite hard. This can be caused by such things as a slightly sticking wheel cylinder or friction between the shoes and backing plate platforms. The extra friction uses up part of the hydraulic force on light applications, so the opposite wheel brakes harder.

Light-effort pull can often occur during lining run-in, too. One lining may wear in faster than its opposite, causing a difference in friction during light braking. Generally, you shouldn't worry about a slight amount of pull on light brake applications while new linings are wearing. The condition will soon correct itself. Don't try to speed up the break-in by making severe stops from high speeds. You'll only succeed in ruining the new lining.

BRAKE SHOE DRAG

Friction between the brake shoes and backing plate platforms also can cause a shoe to hang up. If the platforms are scuffed, or have a heavy paint build-up, the shoe may not return

when the brake is released. Instead it may drag, wear unevenly, or become glazed.

To correct shoe hang-up, dress down the platforms with fine emery cloth. Remove any rough edges or sharp corners from the shoe loops with a fine file. It is good practice to inspect shoe loops and platforms on every re-line job and correct any roughness on either.

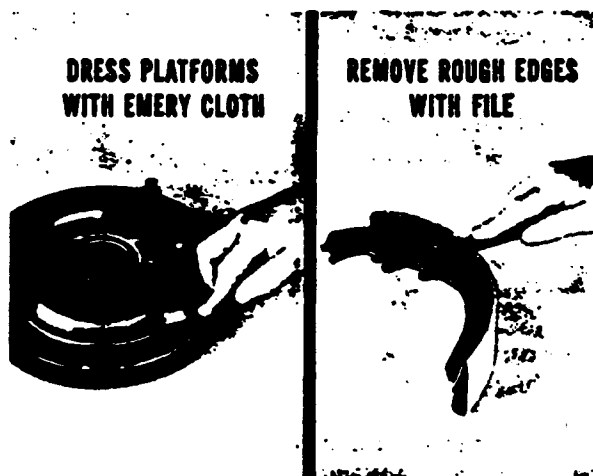


Fig. 6 — Dress down platforms and loops

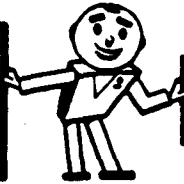
Be careful not to remove too much metal from the loops. This would cause poor contact between the shoe loop and the platform and you'd end up with brake noise.

Before installing the shoes, put a thin coat of Sil-Glyde lubricant on the platforms. Don't use too much and don't get it on the linings.



Fig. 7 — Lubricate platforms sparingly

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BRAKE NOISES

CHATTER

Brake chatter is the result of vibration induced in the brake that can be transmitted to other parts of the car. You might hear it, or just feel it when the brakes are applied.

A loose backing plate may cause the chatter, along with pull, noise and erratic braking. This is easy to diagnose and fix. If the trouble isn't a loose backing plate, you've got some kind of drum trouble. Tech doesn't know of a case of chatter that's been caused by changing linings. So leave the linings alone.

WHEEL STUD NUT TIGHTENING

Often, improper tightening of the wheel stud distorts the brake drums causing chatter during application. Before you pull any drums, loosen and retighten the stud nuts correctly. Often this is all that need be done to correct a case of brake chatter.

Remember to always tighten the stud nuts alternately—first to one-half the recommended torque, then to the full recommended torque.

WHEEL NUT TORQUE

Valiant and Dart	55 ft.-lbs.
All other passenger cars	65 ft.-lbs.

If proper tightening doesn't fix the chatter, check what speed it occurs at. This will give you a clue as to whether it's drum surface irregularity or heat spots on the drums.

HEAT SPOTS—LOW-SPEED CHATTER

A harsh chatter when braking at low speeds—as low as 20 miles per hour—indicates a heat-spotted drum. In high-speed braking, heat spots cause a rumbling noise.

Heat spots are extremely hard areas in the drum, caused by exceeding the drum heat tolerance in severe operation. Chatter is caused by the change in friction in the spotted areas.

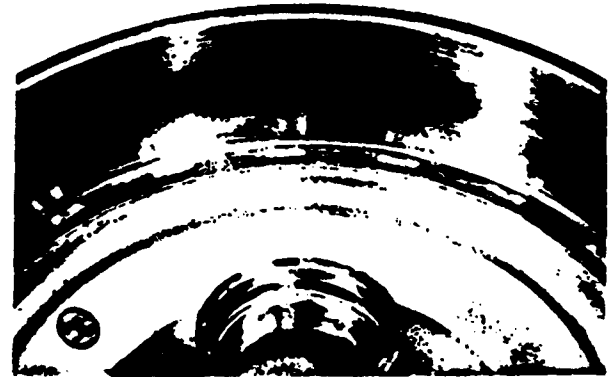


Fig. 8 — "Incipient" heat spot

In their first stage, heat spots show up as blue areas in the drum surface. First stage or *incipient* heat spots can sometimes be removed with coarse-grit emery cloth.

A severe heat spot is a bluish area with a silvery spot in the center. In a severe heat spot, the cast-iron drum material has actually been converted to a very hard steel.



Fig. 9 — Severe heat spot

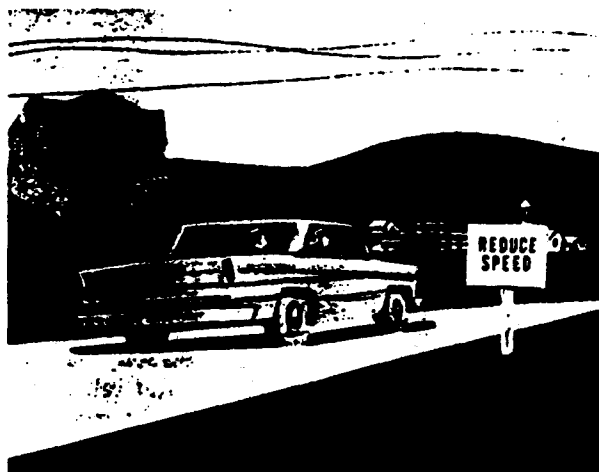
GRIND DRUMS TO REMOVE

Severe heat spots can be removed only by

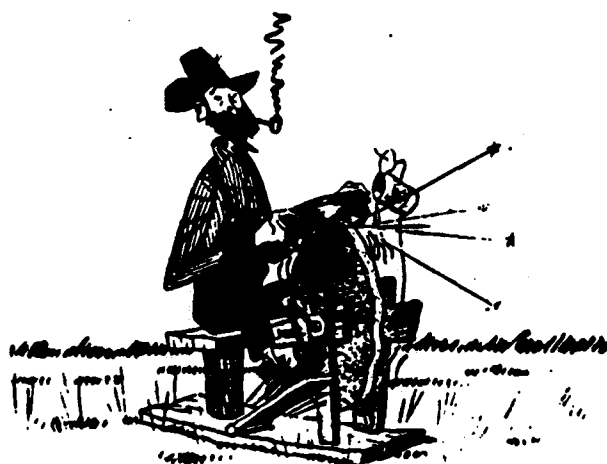
grinding the drums. On a lathe, the cutting tool would bounce as it hit a severe heat spot.

HIGH-SPEED CHATTER

Chatter from drum surface irregularities occurs in light-effort braking from high speeds—usually above 60 m.p.h. It usually continues down through about 40 m.p.h. However, the chatter may not come in at all on heavy brake applications or light applications from speeds lower than 55-60 m.p.h.



The drum surface irregularities which cause high-speed chatter are very slight—you can't measure them easily. They are usually induced in the drum by casting and machining stresses. Of course, all the drums are stress-relieved in production by heat treating. But sometimes the heat and pressure created by severe braking may cause additional relief or changes in



the internal stress of the drum. In other words, the drums may not be entirely stress-relieved until they've seen some service.

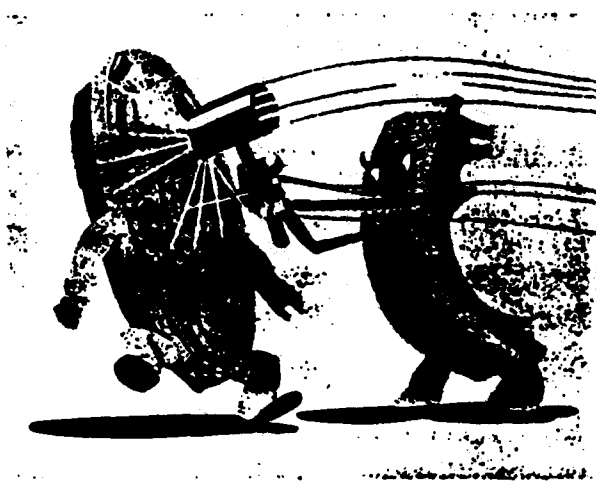
If high-speed chatter develops on a new car, give the linings time to wear in through normal stops. If the chatter persists, the front drums should be resurfaced on a drum grinder to correct the irregularities. The problem won't occur again because the drums have been thoroughly stress relieved.

Only a small thickness of material needs to be removed, so grinding is again in order. On a light lathe cut, the tool tends to follow the irregularities instead of making a true cut. Of course, you could make a deeper lathe cut but the more metal you leave on the drum the better.

Normally, only the front drums need grinding to correct high-speed chatter. The rear brakes are not apt to cause this condition. The rear suspension damps out any chatter that does occur, so it's not felt or heard inside the car.

SHOE KNOCK

"Shoe knock" or "shoe slap" is a condition where the shoe is pulled away from the backing plate, and then snapped back by the hold-down spring. The "knock" or "slap" is the sound of the shoe hitting the platforms.



The problem is caused by spiral cutting tool marks on the drum face. This results in a threading action which pulls the shoes on the left-hand wheels away from the backing plate during braking.

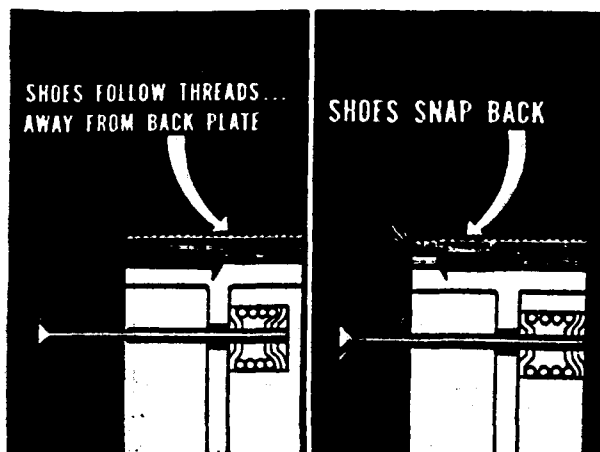


Fig. 10 — Threading causes shoe knock

To correct shoe knock, break up the helix by vigorous hand-sanding with 60- or 80-grit emery paper. Machining isn't necessary unless the finish is very poor and the "threads" are quite deep.

SHOE SCRAPE—10" BRAKE

Shoe scrape occasionally shows up in the left rear brake of a Plymouth or Dodge. It's caused by the secondary shoe moving out and rubbing against the drum during braking. When this happens, you'll be able to see an interference mark at the adjuster end of the secondary shoe with the drum off.

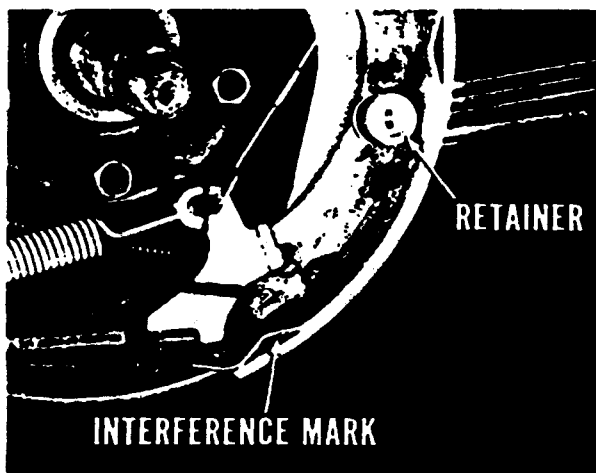


Fig. 11 — Shoe scrape interference mark

Installing an extra hold-down spring retainer usually gives you enough hold-down force to prevent the shoe from moving out. In some

extreme cases, you may need to install two extra retainers. Don't do this, though, unless it's absolutely necessary. Too much hold-down force can cause poor shoe return and shoe drag.

FRONT BRAKE HOWL

A loud, low-pitched howl in the front brakes, usually loudest in a turn, may be caused by the brake shoes rubbing on a center platform that is too high. This condition is corrected by carefully grinding the center platforms.

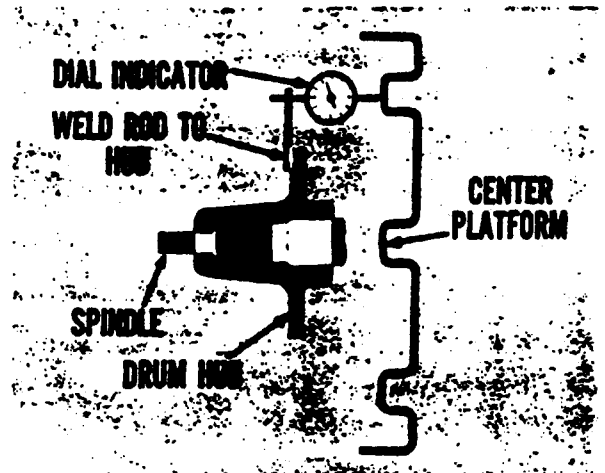
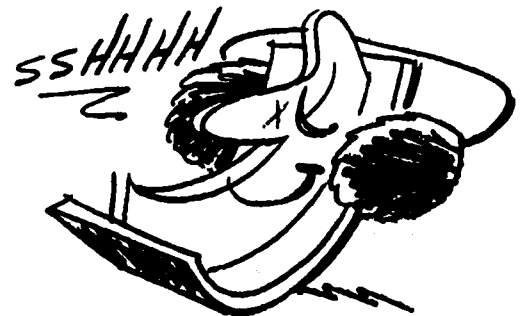
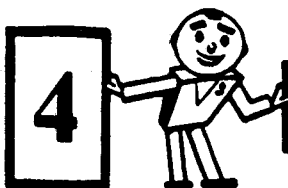


Fig. 12 — Measure platform height

To measure the platform height, attach a dial indicator to an arm welded onto a discarded brake drum hub as shown in the illustration. Install the hub on the wheel spindle and tighten it so there's no end play. Measure the height of all the platforms. Grind enough off each center platform so its height is .005 to .015 inches less than the lower of the two platforms on either side of it.

Smooth the platforms with emery paper and lubricate them sparingly with Sil-Glyde before you reinstall the brake shoes.





SERVICING THE BRAKE SYSTEM

KEEP IT CLEAN

Like any other hydraulic system, the brake system doesn't tolerate dirt. Fluid contamination leads to problems like leakage, rust and sticking cylinders. So be very careful anytime you're servicing the hydraulic system. Don't let any contamination get in during assembly or when adding fluid.



Use the approved procedure for bleeding and watch for evidence of contamination during bleeding. Flush and refill the whole system, if necessary, to eliminate all contamination.

USE APPROVED BRAKE FLUID

When it's necessary to add brake fluid, be sure to use only heavy-duty fluid that conforms to the specifications of SAE 70 R 1 and SAE 70 R 3. Mopar and Chryco brake fluid meets or exceeds these specifications. It has the high boiling point required for safe operation. Don't take a chance on unknown brake fluids that might boil away, break down, or be incompatible with fluid already in the system.

PROTECT THE LININGS

Treat brake linings like a new baby. Don't let them get contaminated with oil, grease, or water. Don't even get dirty fingerprints on the linings.



When you're servicing wheel bearings and the like, be careful with the grease. And be sure to replace any leaking seal you spot that could let the linings get contaminated.

SPEAKING OF SEALS . . .

There's a new seal between the rear wheel cylinders and the backing plate on 10- and 11-inch brakes. The seal is there to keep water from getting past the wheel cylinder opening in the backing plate and running into the axle shaft bearings. You'll find this seal on late-production '64 models.

If you are working on an earlier model that does not have this seal, you should use Miracle Black Magic Adhesive to seal around the cylinder. This is good insurance against premature rear-axle bearing damage.

CHECKING FOR HYDRAULIC SYSTEM LEAKS

You can sometimes tell if there's a fluid leak by holding a heavy foot on the brake pedal for about thirty seconds. If the pedal sinks slowly, there's definitely a fluid leak somewhere in the brake hydraulic system. It could be an external leak or it may be internal leakage in the master cylinder. A sinking pedal and low fluid in the master cylinder reservoir means an external leak. A sinking pedal but no loss of fluid means master cylinder trouble.

Don't always assume there's a leak just because the fluid level is low. Sometimes the reservoir cover isn't sealing perfectly and fluid sloshes out during stops and starts.

So look for evidence of leakage around the master cylinder, and replace the cover gasket if necessary.

WHEEL CYLINDER LEAKS

To see whether a wheel cylinder leaks, you'll have to pull the drums. Pull back the lower lip of the wheel cylinder boots and look for fluid under them. In fact, it's a good idea to do this anytime you have a drum off for any reason.

IMPORTANT: *If there's any fluid under the boot, the cylinder needs rebuilding.*



Fig. 13 — Check for wheel cylinder leaks

LOOK FOR AXLE GREASE, TOO

Occasionally someone is a little too generous with front wheel bearing grease. The excess grease gets out past the seal and onto the drum and lining.

Anytime you see an accumulation of grease at the center of the backing plate, check for excess grease and a leaking seal. Of course, if this isn't caught early, the grease eventually gets on the linings and they have to be replaced.

If you see rear axle gear lubricant, it will probably be spattered all over the backing plate and brakes. This indicates a leaking axle shaft inner seal.

USE THE CORRECT LININGS

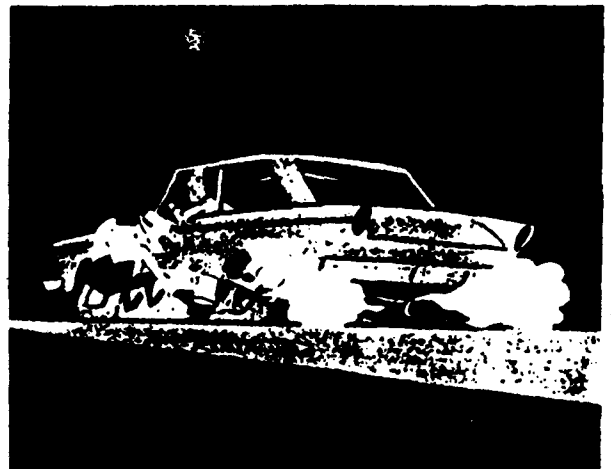
Always match the linings correctly and use only approved linings. The table lists the color codes for 1964 cars. Notice that there has been a mid-year change in police brake linings. Both the original and the newly released linings are listed. Don't mix them if you have a reline job.

1964 LINING COLOR CODES

CAR	SIZE	PRIMARY COLOR CODE	SECONDARY COLOR CODE
Valiant-Dart	9"	1 RED 1 YELLOW	2 RED
Plymouth-Dodge	10"	1 RED 1 BLACK	2 RED 1 BLACK
Plymouth-Dodge Taxi	11"	1 BLACK 2 WHITE	1 WHITE 1 GREEN
Plymouth-Dodge Police and H.D. (original release)	11"	3 BLACK	2 BLACK 1 WHITE
Plymouth-Dodge Police and H.D. (latest release)	11"	1 BLACK 1 ORANGE	2 RED
Dodge 880, Chrysler, Imperial	11"	1 BLACK 1 ORANGE	2 RED

DON'T BURN THEM IN

Tech says that you can't burn new linings in—you can only burn them out. Whatever you do, avoid unnecessary severe stops with new



linings. Give them a chance to wear in. It takes a hundred or more normal stops to break new linings in. Don't try to do it in two or three. Here's why:

HEEL-AND-TOE CLEARANCE

New Chrysler and Chryco shoe and lining assemblies are ground under the drum diameter for heel-and-toe clearance on initial contact. If the linings didn't have this clearance, heel-and-toe contact with the drum would cause noise and instability on light applications. You should *never* install a shoe and lining assembly that doesn't have .004-inch heel-and-toe clearance with the drum.



Fig. 14 — Heel-and-toe clearance

With heel-and-toe clearance then, there's a run-in period when contact is mostly on the center part of the lining. Severe stops create excess heat and can scuff or glaze the lining, or bleed out the friction particles.

HANDLE DRUMS CAREFULLY

It pays to baby the brake drums, too. Don't drop them—even a few inches. And don't even bump them against anything. A bump can distort a drum and cause chatter or pedal pulsation. To get an idea of how important this is, notice the way MoPar and Chryco Servo-Contact replacement drums are protected against shocks when you receive them. They're now individually packaged and protected by a cushioning material.



MATCHING DRUMS

Drums should always be resurfaced in pairs to avoid different braking surfaces. During machining it's best to have the wheel mounted on the drum, with the stud nuts properly torqued. This prevents drum distortion during machining. If the equipment won't handle a wheel, use a 1/2-inch-thick plate, flat within .005-inch mounted to the drum.

USE GOOD EQUIPMENT

Be sure your drum lathe or grinder is in good condition—capable of giving the precision required on brake drums.

On a drum lathe, be sure the cutting tool is sharp and set square to give a smooth cut without leaving machining marks. Make sure, too, that the toolholder isn't loose. This would allow the tool to bounce or follow existing irregularities.

If you grind the drums, use the correct grinding wheel and keep it dressed properly. Follow the equipment manufacturer's operating recommendations, particularly on speed and feed settings.

DEPTH OF CUT

Remove only enough material to be sure the drum is perfectly round and free of surface irregularities. Never enlarge a drum more than .060" over standard drum diameter. In other words, never remove more than .030" of material from the drum.

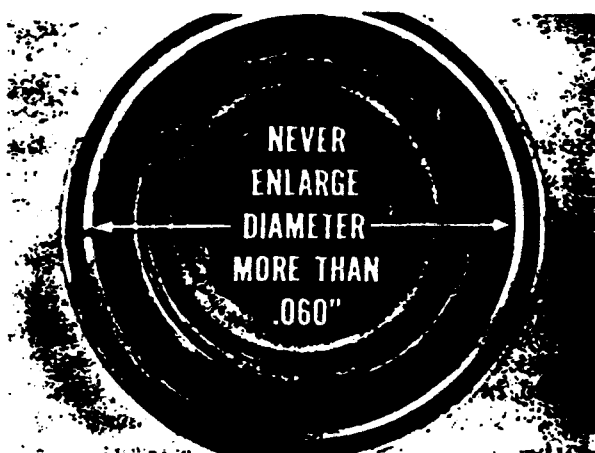
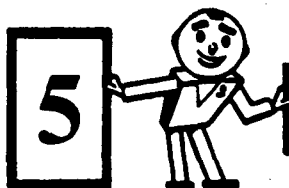


Fig. 15 — Don't cut too deep

After machining, vigorously rub the new sur-



SERVICING ADJUSTERS

LOW PEDAL

Automatic brake adjusters maintain the correct shoe-to-drum clearance and proper pedal height. Of course, if a car equipped with automatic adjusters has a low pedal it *could* mean that at least one of the adjusters isn't keeping the clearance set correctly. If you suspect that one or more automatic adjusters aren't working, see if a few fairly hard brake applications in reverse will correct the problem. That may be all that's needed to loosen a tight adjusting screw. If this fails to help, you'll have to check the operation of each adjuster.

TO TEST AUTOMATIC ADJUSTERS

The easiest way to test adjuster operation is to back off the adjustment at all brakes to be sure they need adjustment, then spin each wheel backwards and see if the adjuster operates when the brakes are applied. Here are the details:

Test preparation: Raise the car on a hoist. Remove the cover from the rear adjustment slot in each brake support plate so you can see

face with emery cloth. The braking surface should have a dull finish all over. Too polished a surface will glaze the linings, causing squeal and pull.

CLEAN THEM UP GOOD

However you resurface drums—on a lathe or grinder, or simply by hand sanding—be sure to clean them thoroughly afterward. Wipe the entire drum with a clean, dry cloth to get rid of any abrasive particles. Don't use compressed air for this job, unless the line has a water and air filter, and you're sure the filter is clean.

Don't use solvents, either, particularly oily ones. Avoid dirty rags and keep away with greasy hands. Any trace of oil or grease on the drum will contaminate the linings.

the adjuster star wheel. Then stick a thin screwdriver through the adjusting hole and push the adjuster lever out of engagement with the star wheel. Be sure to hold the lever there while you back off the star wheel about thirty notches. That way, you'll be sure the brake actually needs adjustment. If it's extremely difficult or impossible to turn the star wheel, the trouble may be corroded threads on the adjusting screw.

Observe adjuster operation: You'll need someone in the driver's seat to apply the brakes. Spin the wheel in the reverse direction and have your helper apply the brakes *hard*. This will move the secondary shoe, causing the adjuster cable to pull the adjuster lever up. Then, when the pedal is released, the lever should snap downward, turning the star wheel. So, if the adjuster mechanism is working, you should see a definite rotation of the star wheel.

Check all four adjusters—more than one may be causing the trouble. If you find an automatic adjuster that doesn't function as it should, you'll have to pull the brake drum to service the adjuster.

TEST ADJUSTER WITH DRUM REMOVED

Here's a simple way to test the adjuster after you've removed the drum. Pry the rear brake shoe away about an eighth-of-an-inch from the anchor pin at the top of the brake while watching the adjuster lever. This lever should engage the next tooth of the star wheel with an audible click. Then, when you let the shoe return, the lever should turn the star wheel slightly to lengthen the adjusting screw.

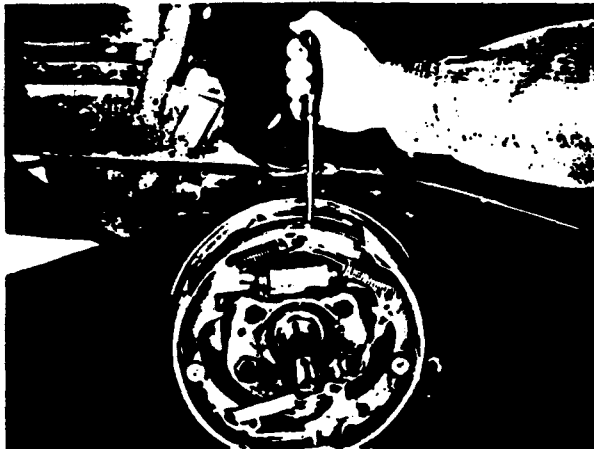


Fig. 16 — Test adjuster with drum off

CABLE BINDING AT GUIDE

If the cable guide isn't flush against the shoe web, the adjuster cable could shift and be pinched between the guide and the web. The cable may bind at that point and fail to oper-

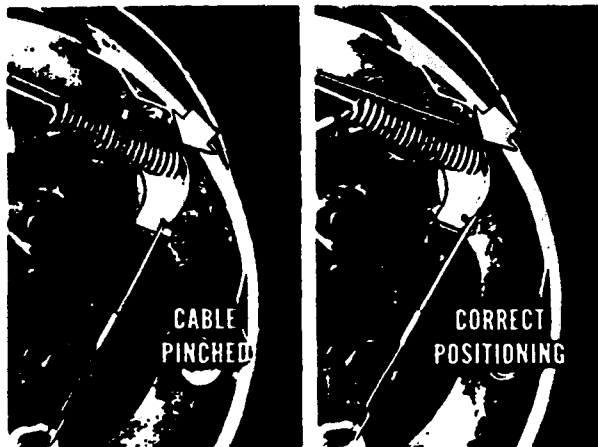


Fig. 17 — Check cable for binding at guide

ate the adjuster lever. To correct this condition, just position the cable in the guide groove and make sure there's no gap between the guide and the shoe web. It's okay to lubricate the cable guides *sparingly* with Silglyde so the cable will operate easier, but be very careful to avoid getting even the slightest trace of lubricant on the brake linings or drums.

CABLE EYE IMPROPERLY INSTALLED

To assure free operation of the adjuster cable, it must be properly installed. The cable eye should be positioned on the anchor pin with the crimped-down tabs that hold the cable to the eye facing outward. On all cars except Valiant and Dart, the cable eye must be assembled underneath *both* brake shoe return springs. On Valiant and Dart brakes only, the adjuster cable eye should be installed so that it is *between* the two shoe return springs—primary spring first, then cable eye and finally the secondary spring.



Fig. 18 — Install cable eye correctly

Assembly tip: Whenever you're installing an adjuster cable, remember to do this. Before you hook the shoe return spring to the anchor pin over the eye, pull firmly down on the adjuster cable in the direction of the cable guide. This will insure that the effective length of the cable is correct.

BINDING STAR WHEEL ADJUSTING SCREW

If the star wheel won't turn even though the adjuster cable and lever appear to be in good shape, the threads on the star wheel adjusting

screw might be corroded and binding. In this case, try to free up the threads before you consider replacing the adjusting screw. Sometimes, a few drops of Manifold Heat Control Solvent will help to loosen up the adjusting screw—but be sure to apply it carefully to the threads. Avoid getting solvent on the linings.

OVERADJUSTMENT

In ordinary use, the automatic adjusters will always maintain correct shoe-to-lining clearance without overadjusting. But there are conditions of severe usage where they can adjust the shoes too tight, resulting in drag and pedal build-up.

This occurs when the car is backed up when the drums are overheated after a severe stop or after riding the brakes going downhill. An overheated drum expands—the diameter enlarges. The automatic adjusters don't know the drum diameters are oversize. All they know is that the secondary shoes are traveling far enough during reverse braking to move the lever up another notch. So the brakes adjust for the enlarged diameter and they're too tight when the drum cools.

If you run across this condition, you'll have to make a manual adjustment to correct it and educate the driver on how to avoid it. Tell him to prevent a recurrence by hesitating a few seconds after using the brakes before he backs up. This will give the drums a chance to cool and return to normal size. In extreme cases where car usage requires backing up with the drum hot regularly, the owner should change to manual adjusters.

USE THE RIGHT ADJUSTER



Fig. 19 — "R" for right side; "L" for left side

Cars that have manual adjusters use the same adjuster on all four wheels. With automatic adjusters, though, the thread direction is different on opposite sides of the car. Always install the adjusters stamped "R" on the right side of the car and the adjusters stamped "L" on the left side. If you get them mixed, automatic adjuster action will increase the lining-to-drum clearance, causing low pedal.

The adjusters also have different thread pitches for precise adjustment of the different size brakes. It's not always easy to tell the star wheels apart. But you can easily identify the correct pivot nuts by the U- and V-shaped

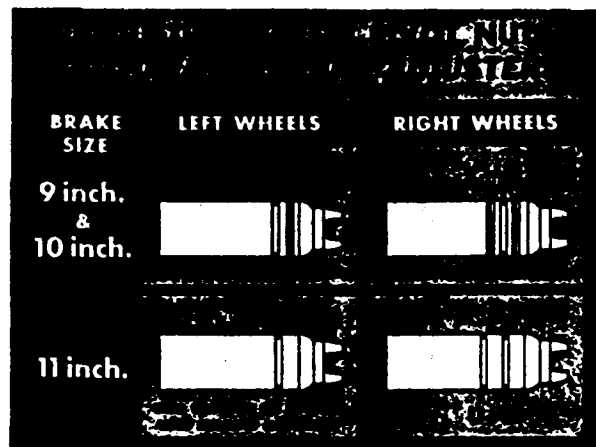


Fig. 20 — Adjuster identification

grooves in the nuts. And you can't put a wrong star wheel into a pivot nut because of the different threads.

MANUAL ADJUSTMENT

Before you button up a brake assembly, check how many teeth there are in the adjuster star wheel. Manual adjusters have twelve teeth; automatic adjusters have 24 or 30. To adjust the lining-to-drum clearance, tighten the adjuster until you feel a drag at the wheel. Then back the adjuster off a full half turn—one-half the number of teeth in the wheel. Check that there's no trace of drag.

REFERENCE
BOOK

MASTER TECHNICIANS
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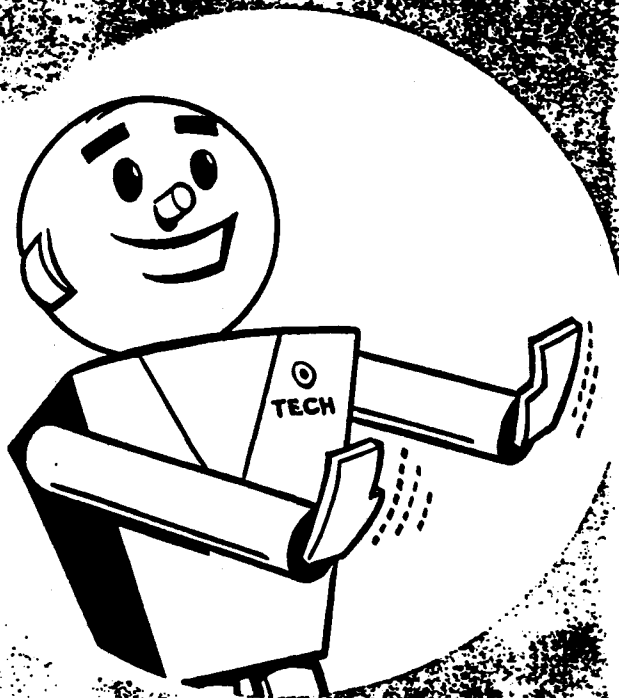
DUAL

HYDRAULIC BRAKE SYSTEM

PLYMOUTH • DODGE
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CHRYSLER
MOTORS CORPORATION



There's nothing complicated about the new dual hydraulic brake system. However, some of the components are different and there are a lot more pieces and parts than in previous systems. That's because a number of new requirements had to be taken into consideration in designing the dual hydraulic system.

Of course the primary objective was to design separate hydraulic systems for the front and rear brakes. The design had to insure that loss of pressure in one system wouldn't result in loss of pressure in the other system. Furthermore, in normal operation the new system must provide equal hydraulic pressure to the front and rear brake systems. In other words, the entire system must be hydraulically self-equalizing. As you know, this feature is one of the most important advantages of *any* hydraulic brake system.

Still another design requirement had to be satisfied. The dual brake system had to provide a signal device that would warn the driver of pressure loss in case of damage or failure in either the front or rear hydraulic system. This was accomplished with a hydraulic warning light switch and brake warning light.

It took a completely new master cylinder and a new warning light operating switch to accomplish these basic design objectives. And, it'll take an understanding of how these units work to do a good job of servicing and troubleshooting the tandem master cylinder hydraulic system. There's nothing in the new brake system that'll give you any trouble if you'll take the time to read this reference book and find out what dual brakes are all about.

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TANDEM MASTER CYLINDER HYDRAULICS

Let's get oriented to the dual hydraulic system. The master cylinder is really a tandem unit with two separate hydraulic pressure systems. The lines from the separate outlets are connected to the new brake warning light switch assembly. The switch part of the assembly controls the ground circuit for the brake warning light. The switch housing also serves as a brake line "tee" and routes pressure from the tandem master cylinder to the separate front and rear brake systems.

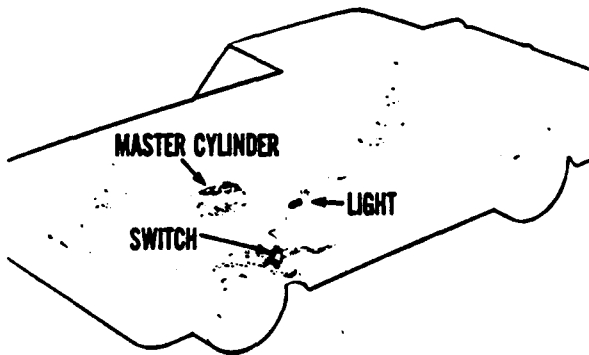


Fig. 1—Brake warning light signals loss of pressure

TWO RESERVOIRS AND ONE BORE

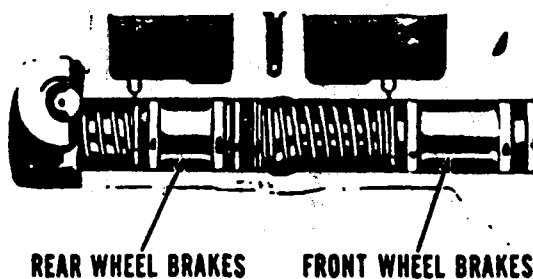


Fig. 2—The master cylinder has two separate pistons

The tandem master cylinder has two separate brake fluid reservoirs arranged one behind the other. However, a single cylinder bore is used. The master cylinder assembly has two separate pistons that operate in tandem. The front piston provides pressure to the rear wheel brake cylinders. The rear piston serves the front wheel brake cylinders.

THINK PRIMARY AND SECONDARY

Since the piston at the front of the master cylinder provides pressure to the rear wheels and the piston at the rear of the master cylinder provides pressure to the front wheels, it's easy to get mixed up when writing or reading about the dual hydraulic system. It will be a lot easier to keep things straight if we call the rear piston the *primary* piston because it is actuated directly by the brake pedal or the power booster. Besides, the primary piston supplies pressure to the front brakes where most of the braking is done.

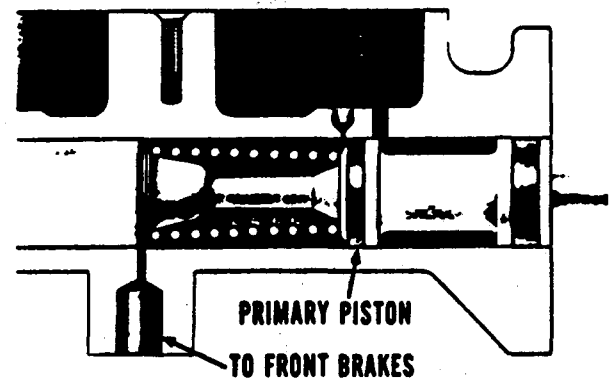


Fig. 3—The primary piston is actuated directly

We'll refer to the piston at the front of the master cylinder as the *secondary* piston. In normal operation, the secondary piston is hydraulically operated by the primary piston, so it actually is a secondary or slave piston. It supplies pressure to the rear brakes.

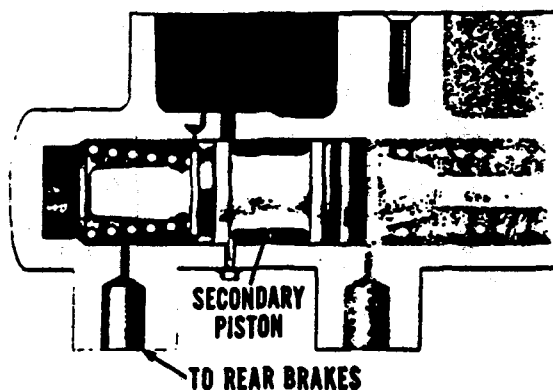


Fig. 4—The secondary is actually a slave piston

YOU REALLY CAN'T GO WRONG!

The first time you work on one of the 1967 model master cylinders you'll notice that the front and rear brake line tube nuts are not the same size. This was done on purpose so that there would be no chance of connecting the lines to the wrong master cylinder outlets.

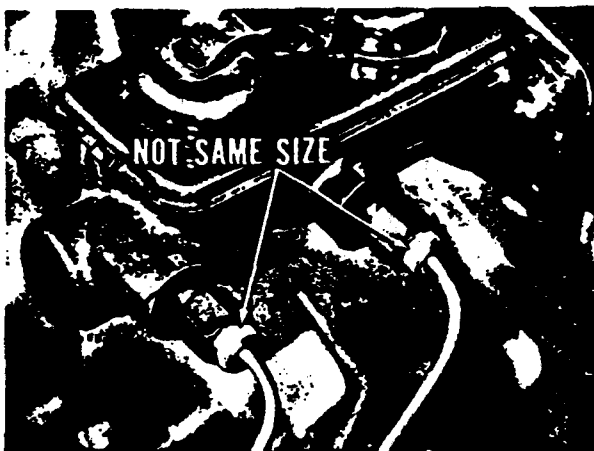


Fig. 5—Different tube nut sizes eliminate wrong connections

In the accompanying illustration you'll also notice that the secondary outlet at the front of the master cylinder is marked "R". This means that this front outlet serves the rear brakes. The primary outlet at the rear of the master cylinder is designated "F" because it serves the front brakes.

RETURN SPRINGS AND PORTS

So far we've left out some of the master cylinder details in order to simplify things. Now,

in a simplified sectional drawing we'll start adding functional parts and tell you what they do.

A piston return spring at the front of the master cylinder pushes the secondary piston back against a piston stop screw. This positions the secondary piston cup slightly to the rear of the compensating port so that the compensating port is open to the secondary reservoir.

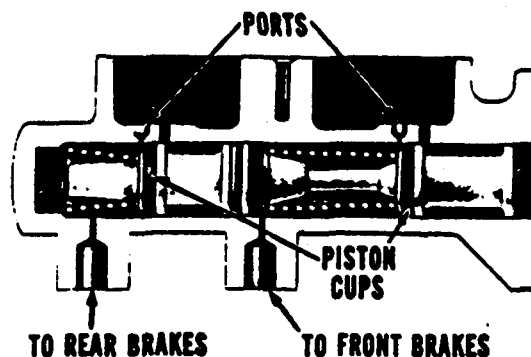


Fig. 6—Cups are slightly behind compensating ports

The primary piston assembly also contains a return spring. It pushes the primary piston back so that primary piston cup is slightly behind the primary compensating port.

THE PRIMARY PISTON RETURN SPRING IS STIFFER

The primary piston return spring is slightly stiffer than the secondary return spring. That means that the secondary return spring is more easily compressed than the primary spring. This difference in return spring pressure affects master cylinder operation and on light brake application causes a slight difference in pressure between the two brake systems.

HERE'S HOW THE MASTER CYLINDER WORKS

When the brakes are applied, the stiffer primary spring pushes the secondary piston forward, compressing the secondary spring slightly. The cup at the front of the secondary piston passes and closes off the secondary compensating port. Pressure in the secondary section of the master cylinder starts to build up. At the same time, the piston cup on the primary piston has closed off the primary compensating port. Fluid is now trapped in front of

each piston. Further pedal movement produces increased pressure in the primary as well as the secondary chamber.

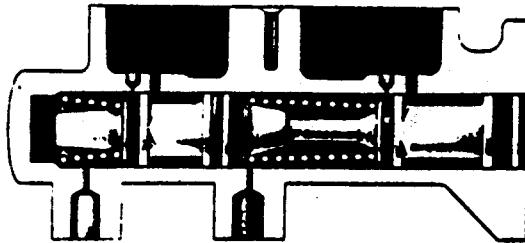


Fig. 7—Pedal movement closes both compensating ports

PRESSURES ARE ALMOST EQUAL

In normal operation, there is a hydraulic link between the primary and the secondary pistons. The secondary piston is actually a slave piston operated by pressure developed in the primary piston chamber. On the other hand, the piston cup at the rear of the secondary piston functions as the "closed end" of the primary chamber and no pressure is developed as long as the secondary piston is free to move forward. As a result of this hydraulic link principle, primary and secondary operating pressures are almost equal—but not quite!

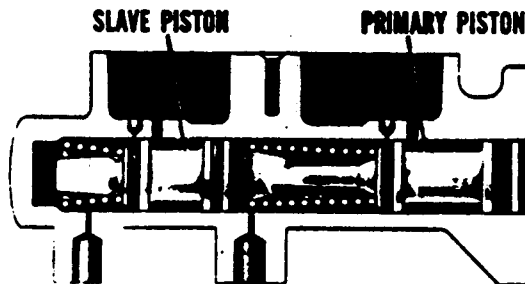


Fig. 8—There is a hydraulic link between the two pistons

SECONDARY PRESSURE'S SLIGHTLY HIGHER

In actual operation, effective hydraulic pressure is proportional to the push rod apply pressure . . . minus the resistance offered by the piston return springs. Since the slightly stiffer primary spring holds its piston back more than the secondary return spring does, secondary pressure is slightly higher than primary pressure. However, the pressure difference is very small compared to the total hydraulic pressure developed when the brakes are applied.

Remember, the primary purpose of the return springs is to return the pistons so that the compensating ports are uncovered when the brake pedal is released. We also depend on these springs to return the brake pedal, since an external pedal return spring is no longer used.

ABOUT THOSE COMPENSATING PORTS

The compensating ports compensate for expansion and contraction of the brake fluid caused by temperature changes. For instance, after repeated brake applications the brake drums and wheel cylinders get pretty hot. In turn, the brake fluid gets hot and expands. If this pressure build-up were not relieved when the brake pedal is released, the brakes would drag and generate more heat and pressure. Instead, when the brake pedal is released, the compensating ports are uncovered and fluid can flow back into the reservoirs relieving excess pressure in the brake lines. When the brake fluid cools off and contracts, fluid flows from the reservoirs and back into the cylinder.

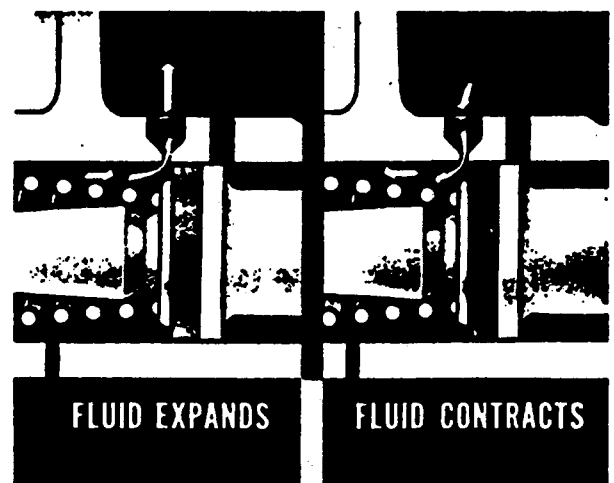


Fig. 9—Ports compensate for expansion and contraction

FILLER PORTS PERMIT PUMP-UP

The main or filler ports serve an entirely different purpose . . . they permit pumping up of the brakes if the pedal is low because of too much lining clearance. This condition could develop if the automatic adjusters aren't working. Here's what happens when you pump the brake pedal to get better pedal height. When the brake pedal is released, the master cylinder return springs return the master cylinder pistons very quickly. By comparison, the brake shoe return springs return the wheel cylinder pistons more slowly. Because of this, the flow of fluid from the wheel cylinders is relatively slow and it has trouble trying to keep up with the movement of the master cylinder pistons.

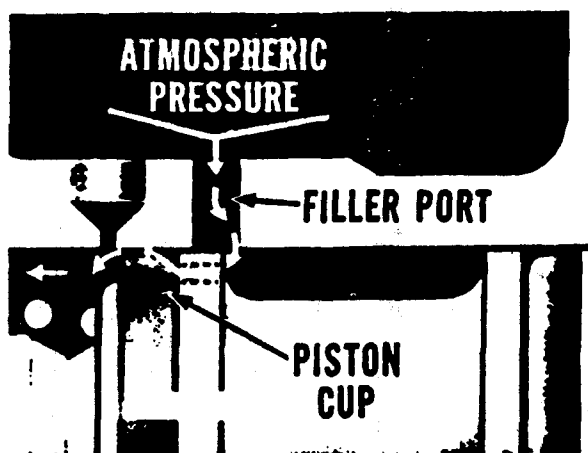


Fig. 10—Atmospheric pressure pushes fluid through ports

As a result, pressure in the master cylinder drops until it is lower than the pressure acting on the fluid in the reservoirs. Atmospheric pressure, acting on the fluid in the reservoir, pushes fluid through the filler port, through holes in the piston and past the piston cup. Fluid flows readily past the piston cup because flow in that direction unseats the lip of the cup.

When brake pedal height is low and the pedal is pumped rapidly, a small amount of additional fluid is forced into the pressure chambers on each release stroke. This increases pedal height until it is nearly normal again. Of course, if lining clearance is excessive, the wheel cylinder return springs force fluid out of the pressure chambers in the master cylinder, through the compensating ports and back into the reservoir as soon as the pumping action stops and the brake pedal is released. Inciden-

tally, we need those filler ports because the compensating ports are too small to handle the flow needed for pumping up the pedal.

On drum brake jobs, residual pressure valves in the master cylinder also contribute to the action that permits pedal pump up. However, this is not the primary purpose of the residual pressure valves.

WHY WE USE RESIDUAL PRESSURE VALVES

The residual pressure valves are located in the master cylinder outlets. They maintain a light pressure in the lines and in the wheel cylinders. If it were not for these valves, air might be sucked past the wheel cylinder cups and enter the wheel cylinder when the brake pedal is released rapidly. Instead, residual pressure keeps the lips of the wheel cylinder cups expanded so that they press outward against the wheel cylinder bore.

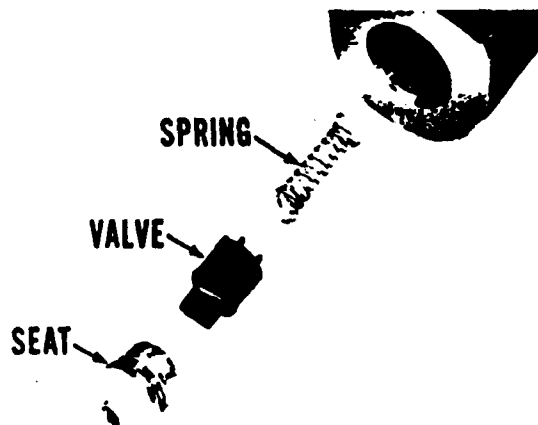


Fig. 11—Residual pressure valves are check valves

RESIDUAL PRESSURE VALVES ARE CHECK VALVES

On past models, the master cylinder had a check valve in the end of the cylinder bore to hold residual pressure in the lines and wheel cylinders. You'll recall that on disc-brake-equipped cars the master cylinder did not have a check valve because residual pressure would cause the disc brake shoes to drag. Since the disc brakes use pistons with seals instead of wheel cylinder cups, there's no danger of sucking in air when the brakes are released. The disc brake piston seals work something like an "O" ring and don't depend on fluid pressure to expand and seat them. So, on past model disc brake jobs the check valve is left out of the

master cylinder and installed in the line to the drum-type brakes at the rear where residual pressure is needed.

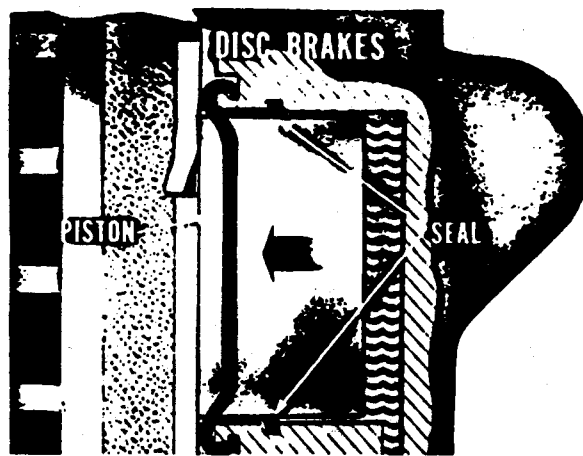


Fig. 12—Disc brakes use seals instead of cups

With the introduction of the tandem master cylinder a single check valve wouldn't work. Since the front and rear brake hydraulic systems must function independently, a separate check valve is needed for each part of the dual system. The new check valves, located in the master cylinder outlets, are now called residual pressure valves. No residual pressure valve is used in the primary outlet of the master cylinder for a disc-brake-equipped car.

THIS IS HOW THOSE RESIDUAL VALVES WORK

The working parts of the residual valve are the tube seat, the rubber valve and the spring. The rubber part of the residual valve is a one-way

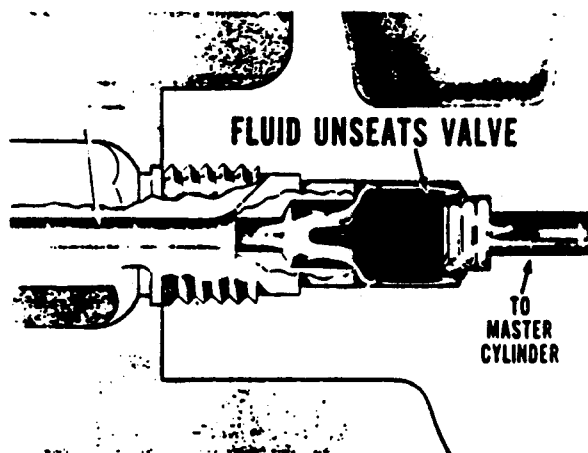


Fig. 13—Flow from wheel cylinders unseats residual valve

valve all by itself. When the brakes are applied, pressure opens a passage through the valve allowing fluid to flow into the brake lines.

When the brakes are released, fluid is pushed out of the wheel cylinders and back toward the master cylinder. This unseats the residual pressure valve and allows fluid to return to the master cylinder. When the pressure in the wheel cylinders and lines drops to about fifteen pounds, the valve is seated by the spring and this residual pressure is maintained until the brakes are again applied.

PRESSURE LOSS IN THE FRONT BRAKE SYSTEM

So far we have concerned ourselves with normal master cylinder and hydraulic system operation. Now, let's see what would happen in case of pressure loss in the front brakes.

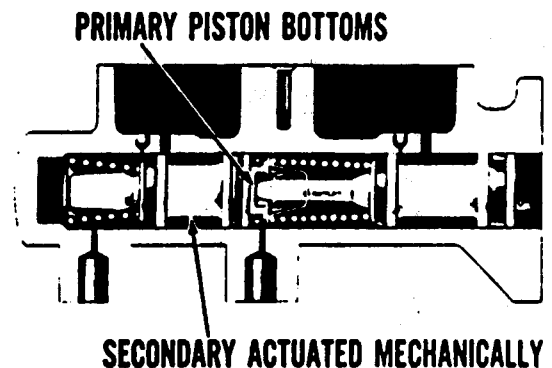


Fig. 14—Pressure loss in the front brake system

If for any reason the front brake hydraulic system fails, there will be no hydraulic resistance to primary piston movement. When you step on the brakes, the primary piston will move forward and compress the primary piston return spring. The projection at the front of the primary piston will bottom out against the secondary piston. The secondary piston will then be actuated mechanically instead of hydraulically to provide rear-wheel braking.

PRESSURE LOSS IN THE REAR BRAKE SYSTEM

If there is a pressure loss in the rear brake system, there is no hydraulic resistance to secondary piston movement. Hydraulic pressure in the primary pressure chamber, plus spring pressure, push the secondary piston forward

until it bottoms against the end of the master cylinder. As soon as the secondary piston bottoms, the primary piston supplies full pressure for normal operation of the front brakes.

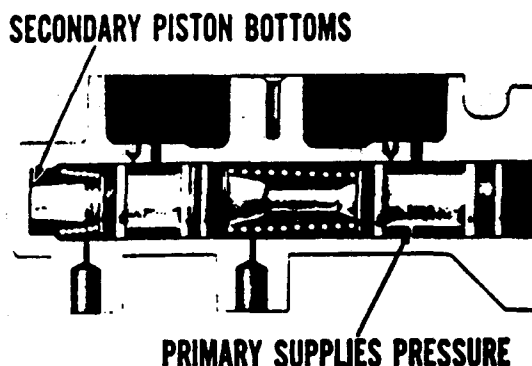


Fig. 15—Pressure loss in the rear brake system

THE HYDRAULIC SYSTEM IS SEALED

The master cylinder reservoirs are sealed by a flexible rubber gasket with integral diaphragms. For all practical purposes, the entire gasket is a very flexible diaphragm. The cylindrical diaphragm portions of the gasket rise or fall as fluid level in the reservoirs goes up or down. In effect, this provides a system that

can "breathe" and is at the same time sealed against the entrance of dirt or moisture.

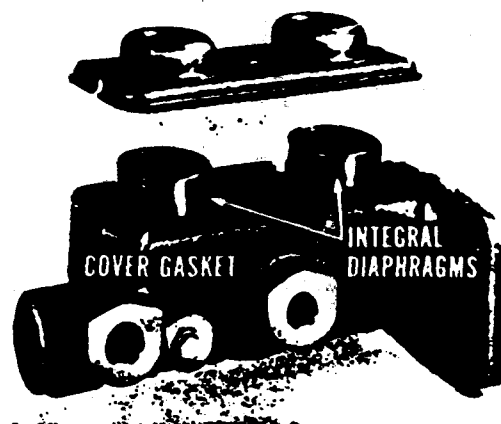


Fig. 16—The hydraulic system is effectively sealed

The space between the master cylinder cover and the diaphragms must be vented to atmosphere so that the diaphragms can react to internal pressure changes. Otherwise, the heat generated by severe stopping conditions could cause fluid expansion, pressure buildup and dragging brakes. To prevent this possibility, small vent grooves are formed in the master cylinder cover. These grooves vent the space between the diaphragm gasket and the cover.

THE BRAKE WARNING LIGHT SYSTEM

Since the front and rear brake hydraulic systems function independently, it is possible that the driver might not notice immediately if pressure and braking is lost in one of the systems. That's why a brake warning light system is required with the new tandem master cylinder and dual hydraulic brake system.

THE WARNING LIGHT DOES DOUBLE DUTY

The brake system warning light serves a dual purpose. In addition to warning the driver if pressure is lost in any part of the system, it tells him if the parking brake is applied as soon as the ignition switch is turned on. Since one light serves as both a parking brake and service brake warning light, the bulb is proofed

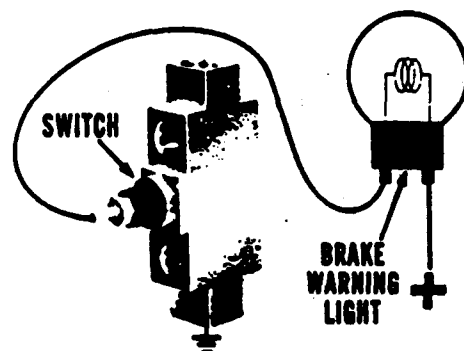


Fig. 17—The brake warning light switch ground circuit

or tested every time the parking brake is applied with the ignition switch on.

The lead wire to the brake warning light is always "hot" when the ignition is turned on. Both the parking brake switch and service brake warning switch are ground circuit switches. Either of these switches can turn the light on by completing the ground circuit. You are already familiar with the mechanically operated parking brake warning light switch, so let's have a closer look at the hydraulically operated service brake warning light switch.

THE BRAKE LINE TEE IS A JUNCTION

The brake line tee or junction between the master cylinder and the front and rear brake lines is no longer a simple tee fitting like it was on past models. It is both a junction and a switch. The front brake system line from the master cylinder primary outlet is connected to one end of the tee fitting. Separate lines to the two front brakes are connected to outlets at the same end of the tee.

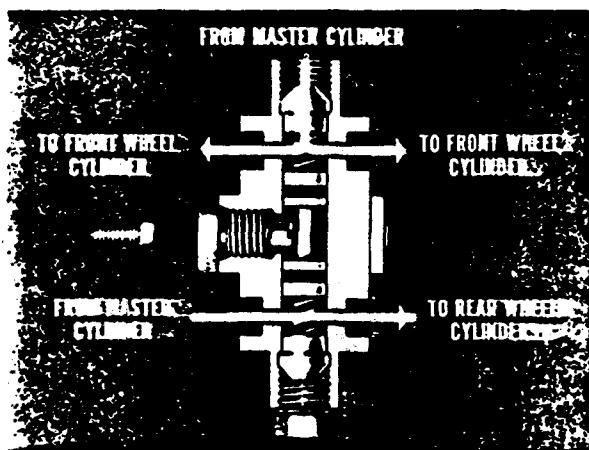


Fig. 18—Brake warning light switch line connections

The rear brake system line from the secondary outlet of the master cylinder is connected into the other end of the tee fitting. The brake line to the rear brakes is also connected to this same end of the tee fitting. Incidentally, different size tube connectors are used for the front and rear brake lines here as well as at the master cylinder. This prevents incorrect brake line connections.

THE TEE IS ALSO A SWITCH

A bar-bell shaped double piston, with an "O"

ring on each end, separates the front and rear brake hydraulic systems. Two small coil springs keep the piston centered as long as pressure is the same in both systems.

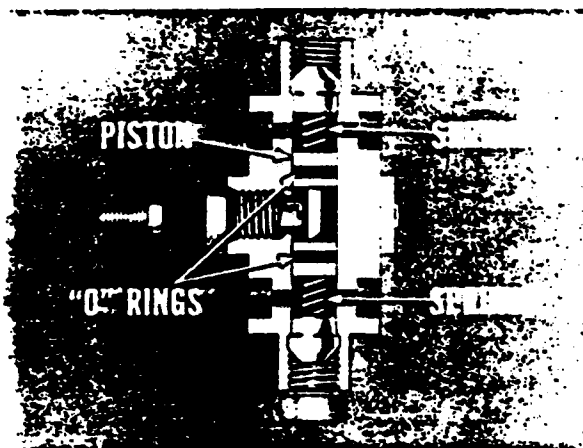


Fig. 19—Springs keep the piston centered

If pressure is lost in one system, for example to the front brakes, pressure in the rear brake system pushes the piston off center. As soon as the piston moves far enough to touch the insulated electrical contact, the ground circuit is completed and the warning light comes on.

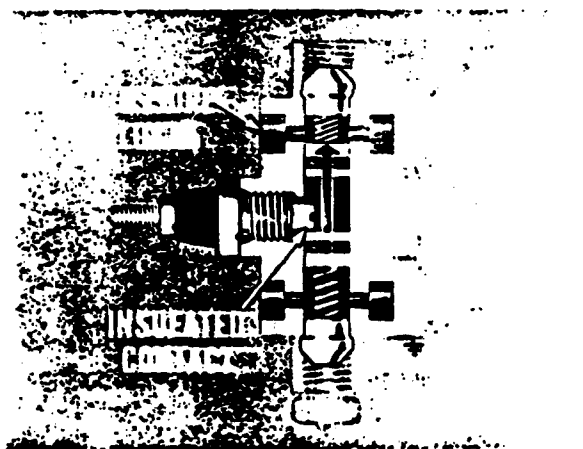


Fig. 20—Pressure pushes the piston off center

The springs in the brake warning light switch are quite stiff so minor variations in pressure will not cause the piston to move far enough to touch the insulated contact. For example, in a disc brake model, residual pressure in the secondary system will not cause the light to come on even though there is no pressure in the primary system.

The same general procedures and precautions apply to servicing the dual hydraulic system and the tandem master cylinder that applied to past models. And, your 1967 Service Manuals have complete removal, disassembly and assembly instructions. However, there are some special precautions and suggestions that will help you do a better job of servicing the new dual hydraulic system.

THIS PUSH ROD'S ATTACHED

On cars and trucks that are not equipped with power brakes, the pedal push rod is retained in the primary piston of the master cylinder. To service this type master cylinder, disconnect the push rod from the pedal and remove it with the master cylinder as an assembly.

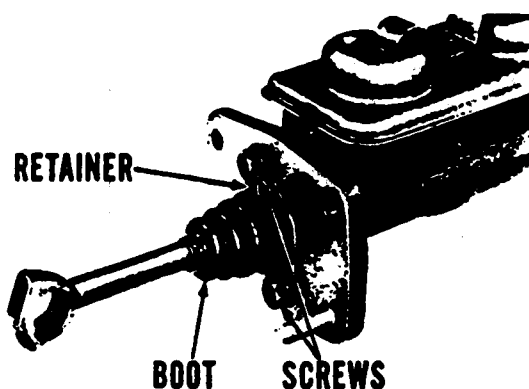


Fig. 21—The push rod is retained in the primary piston

To disassemble this non-power-type master cylinder, remove the piston and boot retainer screws. This will let you remove the piston and the push rod as an assembly.

THE PUSH ROD RETAINER IS RUBBER

By looking at the push rod and piston assembly you can't tell what holds the push rod in place. The accompanying sectional view explains it. The outside diameter of the rubber retainer locks into an internal groove in the master

cylinder piston. The inside diameter of the retainer fits into a groove near the end of the push rod.

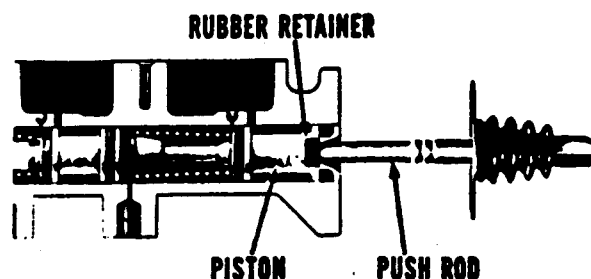


Fig. 22—A rubber retainer locks the push rod in place

TO SEPARATE THE ROD FROM THE PISTON

If you are going to replace the primary piston assembly, you'll have to separate the push rod from the piston. Here's an easy way to pull the rod out of the piston. Use an open vise to hold the piston and a heavy screwdriver to exert leverage on the rod.

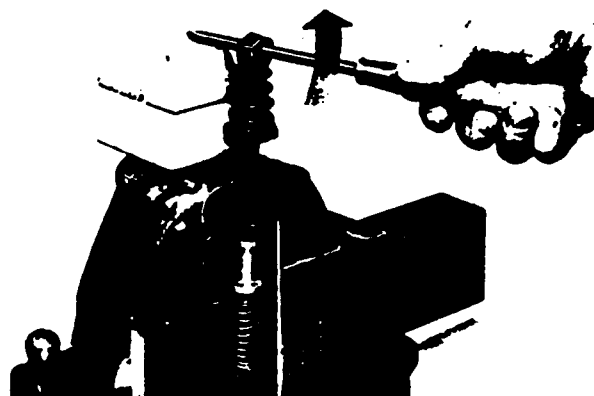


Fig. 23—Use a screwdriver to force the rod out of the piston

USE A NEW PUSH ROD RETAINER

When you reinstall a push rod in a master cylinder, you must use a new rubber retainer. The gripping edges of the old retainer get pretty well chewed up when the rod is pulled out of the piston. A little brake fluid on the rubber retainer will help it slide into the groove in the piston with a minimum of pushing. Most technicians find it easier to assemble the piston in the master cylinder and then force the pedal push rod, with retainer in place, into the piston. Don't forget the metal piston retainer and boot! Tech says he has seen more than one good man assemble the push rod and piston and then find out that the piston retainer won't slip over the "eye" end of the push rod. So, put the piston retainer and boot in place on the push rod first.

DRUM BRAKE SECONDARY PISTON

On the master cylinder for vehicles with drum-type brakes, the secondary piston is retained by a set screw in the side of the master cylinder. Remove it and tap the master cylinder on a soft-top bench to remove the secondary piston.

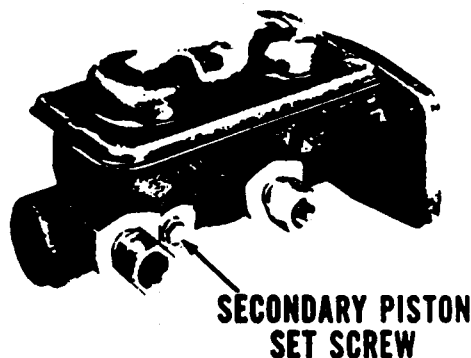


Fig. 24—A set screw retains the secondary piston

IF THE PISTON STICKS

You may find that the secondary piston is stuck in the master cylinder and refuses to be "tapped" out. If this is the case, use air to blow it out of the cylinder. Of course the air pressure will push the lips of the piston cups out and they'll be cut as they pass over the edges of the filler ports. That means they must be replaced when you rebuild the cylinder. As a matter of fact, anytime you overhaul a master

cylinder, use all of the new rubber parts in the repair kit. It's mighty risky to use any of the old parts even if they do look all right.

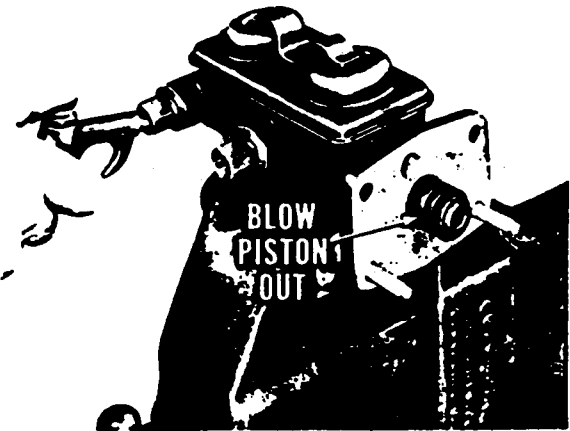


Fig. 25—Air pressure can be used to remove piston

SERVICE THE RESIDUAL PRESSURE VALVES, TOO

You should service the residual pressure valves whenever you rebuild a master cylinder . . . disc or drum type.

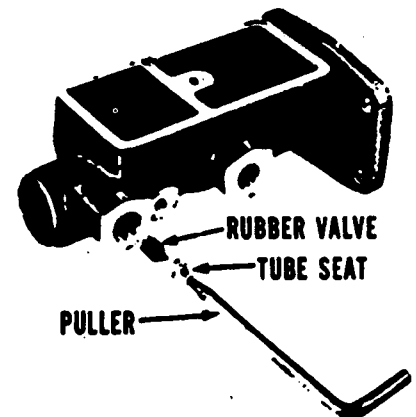


Fig. 26—An easy-out-type puller removes tube seats

Use an easy-out-type puller to remove the tube seats. Discard the tube seats and the rubber valves. Install new valves and tube seats *after* you have cleaned and rebuilt the rest of the master cylinder. Make sure you put a residual pressure valve in both outlets of a drum-type brake master cylinder. Be sure and leave the residual pressure valve out of the primary ("F") outlet of a master cylinder used with disc brakes, but install one in the secondary ("R") outlet.

SOME PISTON RETAINERS ARE DIFFERENT

The master cylinder used with drum-type power brakes is slightly different. The piston is retained by a special retainer at the rear of the cylinder. To disassemble this type cylinder, loosen the piston retainer screw slightly and push in on the piston. Then, flip the piston retainer out of the way. This will let you remove the primary piston assembly.



Fig. 27—Master cylinder for drum-type power brakes

The master cylinder used with power-equipped disc brakes, has a piston set screw that goes through the underside of the cylinder. It retains both the primary and the secondary pistons. You will notice that there is a washer under the head of this retaining set screw. This washer is actually a sealing gasket and must be in place and in good condition when the cylinder is rebuilt. This same precaution ap-

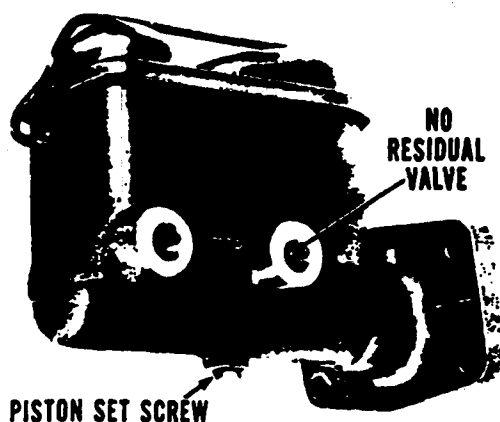


Fig. 28—Master cylinder used with power-type disc brakes

plies to the master cylinder set screw and gasket for drum-type brakes.

CLEANING AND INSPECTION

The master cylinder must be cleaned thoroughly before inspection. Use a suitable solvent and then dry with compressed air. Then, wash the cylinder bore with clean brake fluid to remove all traces of the cleaning solvent.

Inspect the bore for pitting or scoring. Minor scratches or corrosion can usually be polished out using crocus cloth. However, if the bore does not clean up it must be honed.

YOU'LL NEED A SPECIAL HONE

Chances are that the master cylinder hone you've been using won't reach the end of the bore on a tandem master cylinder. A special hone has been released for the new master cylinder. It will be available under special tool number C-3080-A.

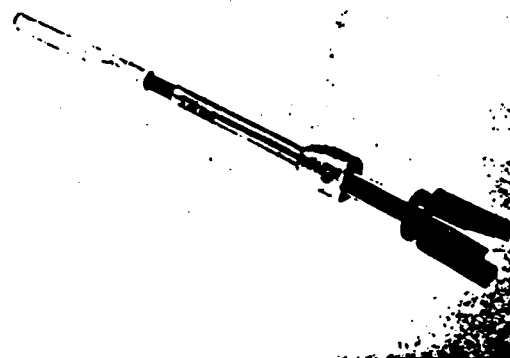


Fig. 29—Special hone for tandem master cylinders

The usual precautions apply when using this hone. The bore diameter of the cylinder must not be increased more than .002 inch. The cylinder must be thoroughly cleaned and inspected after honing. It is very important to make sure the filler ports and the compensating ports are open. Make sure that the honing operation has not raised any burrs or sharp edges at the filler ports that might cut the piston cups.

LUBRICATE WITH BRAKE FLUID

When you are sure the cylinder bore is clean and in good condition, lubricate it with brake

fluid. Dip each rubber part, the piston cups and the "O" ring seal, in clean brake fluid before assembly. This will facilitate assembly and prevent damaging the rubber parts. A dry piston cup is easily cut in passing the filler and compensating ports.

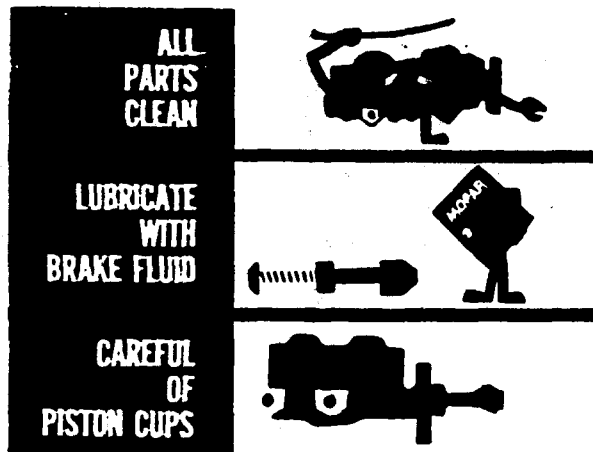


Fig. 30—Master cylinder service precautions

Be especially careful when working the lips of the piston cups into the cylinder or you'll damage them and have a leaker. Keep them well lubricated with brake fluid and make sure the lips of the cups enter the bore evenly.

BENCH BLEEDING IS VERY IMPORTANT

There are many extra parts in the dual hydraulic brake system and more places for air to be trapped. This combination of factors makes it somewhat more difficult to bleed air out of the dual hydraulic system.

Before installing the master cylinder on the vehicle, it should be bench bled. Clamp the master cylinder in a vise and attach bleeding tubes, Tool C-4029, to the master cylinder.

NOTE: When bench bleeding a master cylinder for a vehicle equipped with disc brakes, be sure and attach an external residual pressure valve to the reservoir end of the bleeder tube used at the rear of the master cylinder. If this is not done, the fluid will simply be pumped back and forth through the bleeder tube and trapped air may not be removed. Also, the fluid will be syphoned out of the reservoir when you loosen the bleeder tube nut.

As a matter of fact, the residual valve might as well be left on the rear bleeder tube, even when bleeding a drum-type master cylinder, because it does not interfere in any way with that operation.

Fill both reservoirs with approved brake fluid, then, pump the primary piston full stroke until no more bubbles come out of the bleeder tubes. This may take twenty or thirty strokes, so don't stop pumping until all of the air is bled from the master cylinder.



Fig. 31—Bench-bleeding the tandem master cylinder

Leave the fluid in the bench-bled master cylinder until you install and connect it. The residual pressure valves will prevent the fluid from leaking out of the outlets. However, since there is no residual pressure valve in the primary outlet of a disc brake master cylinder, insert a plug in this outlet or leave the bleeder tube in place until you have installed the master cylinder on the vehicle and are ready to connect the brake lines.

BRAKE LINE BLEEDING SUGGESTIONS

When bleeding air out of the brake lines, the wheel cylinder bleed screws must be fully open. If you crack a bleed screw less than one full turn, an orifice is formed that restricts the flow of fluid. Air trapped in the wheel cylinders, lines or frame tee tends to compress and form tiny bubbles which are difficult to remove.

DON'T DEPEND ON PEDAL FEEL

If the bleeder screws are not opened fully, the brake pedal may feel firm even though all of the air hasn't been bled out of the system. As

a result, the pedal may go almost to the floor after the car has been parked overnight or for several hours. After one or two brake applications, the pedal may again feel firm until the car has been parked for several hours again.

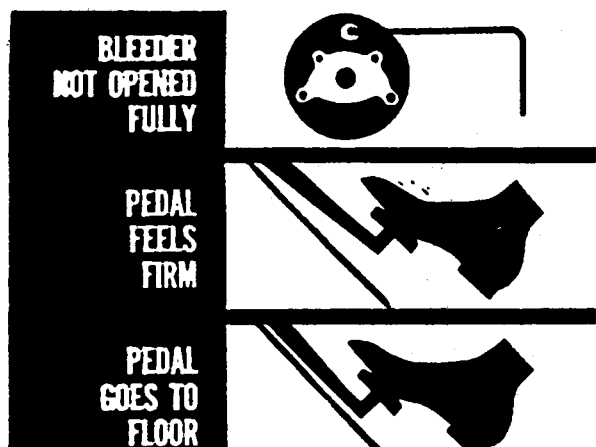


Fig. 32—Partly open bleeder screws cause problems

NOTE: Air in a dual hydraulic brake system doesn't necessarily produce a spongy pedal, so you can't depend on pedal feel to detect air.

GET RID OF THAT AIR

If you run into a case of unexplained loss of pedal after the vehicle has been parked several hours, the best solution is to bleed the master cylinder and lines completely and correctly. Be sure and bleed the master cylinder before you attempt to bleed the rest of the system. If there is air in the master cylinder there's no



Fig. 33—You can bleed the master cylinder on the car

point in trying to pump it through the entire system and out through the wheel cylinder bleeder screws.

It's easy to bleed the master cylinder without removing it from the car. Just disconnect the brake lines, install the bleeder tubes and pump the brake pedal until all air is purged from the master cylinder. Be especially careful to keep the fluid level up when bleeding the master cylinder or lines. If the level gets low, you'll pump air into the system and make a lot of extra work for yourself. Incidentally, if you ever get a job with a dry or very low fluid level in the reservoir, be sure and bleed the master cylinder before you attempt to bleed the rest of the system.

ABOUT THOSE COMPENSATING PORTS

On past models you could easily check compensating port operation by looking into the reservoir to see if fluid squirted out of the port when the brakes were applied. There are two compensating ports to check on the new tandem master cylinder and you'll have to use a slightly different technique to check the rear or primary port.

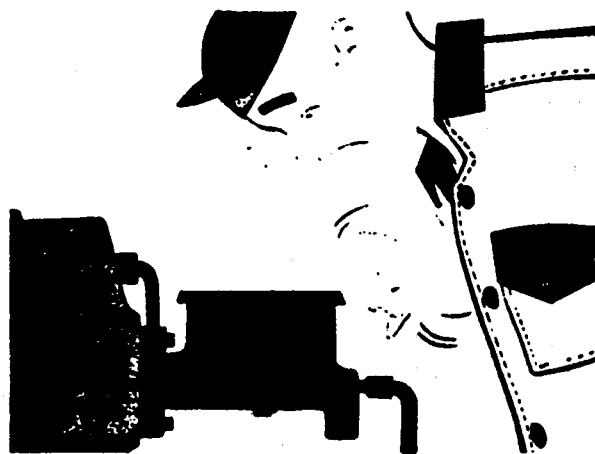


Fig. 34—Past model compensating ports were easy to check

You'll remember that the secondary piston return spring isn't quite as stiff as the primary piston return spring. As a result, the primary piston spring will compress the secondary piston spring slightly when the brakes are applied. The secondary piston and the primary piston will move forward together. As a result, no pressure will be developed in the primary chamber before the compensating port is closed

off by the primary piston cup. Consequently, fluid will not squirt from the primary compensating port when the brakes are applied. However, if the secondary port is open, you should be able to observe the characteristic squirt of fluid from this port as the brakes are applied.

TO CHECK THE PRIMARY COMPENSATING PORT

To check the compensating ports of tandem master cylinder, have someone pump the brakes rapidly and then hold the pedal down hard to maintain pressure in the master cylinder. Then, watch closely while the pedal is released very slowly. If the ports are open you'll see a light spurt or swirl of fluid from the ports as they are uncovered.

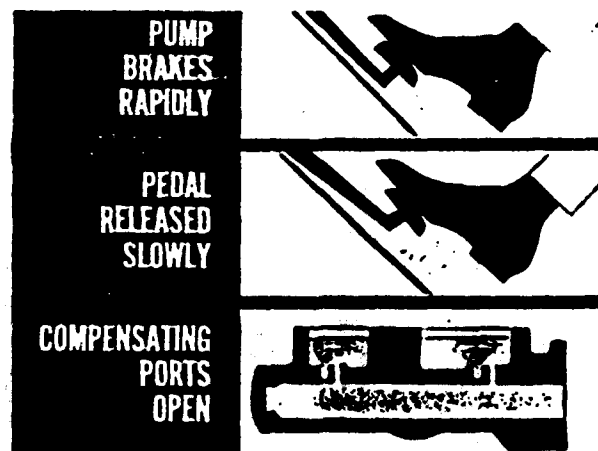


Fig. 35—Test tandem master cylinder compensating ports

If you don't see fluid swirling out of the ports, repeat the test several times to make sure the ports are not compensating before you attempt any corrective measures. Remember, you will have to watch quite closely to observe the swirl from the primary port. The spurt from the secondary port is more readily seen and will occur both when the brakes are applied and when they are released after "pumping up".

A PARTING WORD OF CAUTION

It was not the intent of the foregoing discussion of compensating ports to imply that compensating port troubles might be more common on the tandem master cylinder than they were with the single piston master cylinder. On the contrary, there is no reason to believe that failure of the compensating ports to compensate should be a common occurrence. The

purpose of this discussion was merely to point out that you shouldn't jump to the conclusion that the primary port isn't compensating just because you don't see a squirt of fluid when the brakes are applied.

As a matter of practical logic, incorrect push rod travel is the condition most apt to hold the master cylinder pistons back so that the compensating ports are not uncovered when the pedal is released. On vehicles without power brakes, the pedal push rod length is not adjustable and will not interfere with compensating port operation if it and the master cylinder are correctly installed.

The power brake push rod is adjustable but will be the correct length and *will not* cause problems unless it has been tampered with. However, if someone has overhauled the power booster unit and then discovers that the compensating ports are not opening, you should be strongly suspicious that someone has slipped up when reassembling the power booster unit. If someone has failed to install a snap ring correctly, for example, this condition should be corrected rather than misadjusting the push rod so that the ports will open.



MASTER TECHNICIANS SERVICE CONFERENCE 66-2

REFERENCE BOOK



**DISC
BRAKES**



CHRYSLER
CORPORATION

PLYMOUTH • DODGE
CHRYSLER • IMPERIAL

STOP!

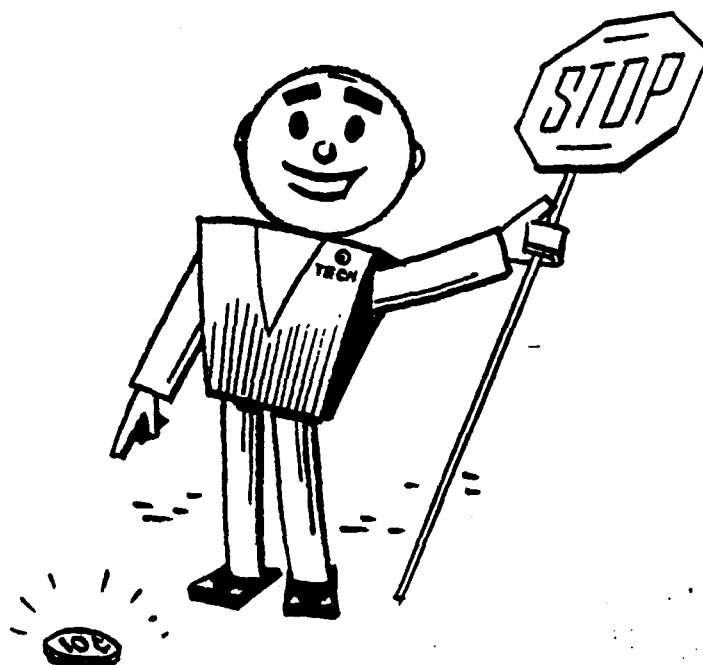
That's what our customers expect when they push the brake pedal. And, that's what they get: a safe, stable stop every time. Even after a panic stop, the car is in its own lane, instead of being slewed around crosswise to the road.

In keeping with the tradition of providing the best braking systems in the automobile industry, Chrysler Corporation is offering, as optional equipment, caliper-type disc brakes on some 1966 models. Specifically, the Valiant, Dart, Barracuda, Fury, Polara, Monaco and all Chryslers have disc options in their lines.

Each predicts that you'll enjoy working on disc brakes. And, as they become better known to the buying public as the safest, most dependable brakes available, there is little doubt that you'll be seeing more and more of them.

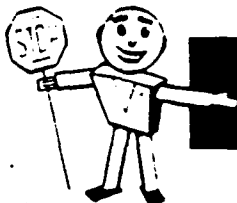
This reference book describes the operation of the two disc brake systems available in 1966. (One system for the smaller cars, another for the larger cars.) Although the principles of operation of the two systems are very similar, there are some structural differences that vary servicing procedures. For instance, replacement of shoes on either of the units is very simple, and takes only a few minutes. But, there is a different procedure for each type that you'll want to know about.

The book contains some other tips on service procedures, so be sure to look it over carefully and add it to your reference book library.



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THIS BUSINESS OF STOPPING

There isn't much doubt that the best safety device on any automobile, old or new, is a careful, skilled driver. Even the most carefully designed car can become a thing of danger in the wrong hands. On the other hand, the most careful and highly skilled driver has to rely upon the dependability of all the components of his car to keep him and his passengers safe.

A SPRAG BRAKE

A few thousand years ago, a man with a name something like Ogachuk Gug discovered that a round wheel was a mighty handy gadget for transporting dinosaur steaks back to the cave. It was tough going on the uphill grades, but it was almost as tough going downhill, until he discovered that a log sprag worked fine as a method of preventing a runaway wagon.



FRICTION SHOES

A few thousand years later, Wells Fargo was using a friction-type brake to control the speed of the Overland Stage. Some of those old trails covered some mighty rough country, and the horses needed help to hold the stage from running away down the side of a mountain. The driver stepped on a pedal and a shoe rubbed a wheel rim to help slow the stage.

SELF-POWERED VEHICLES

As the world progressed into the age of the automobile, the need for more powerful brakes soon became evident. Vehicles were heavier, and they moved faster. In a few short years,

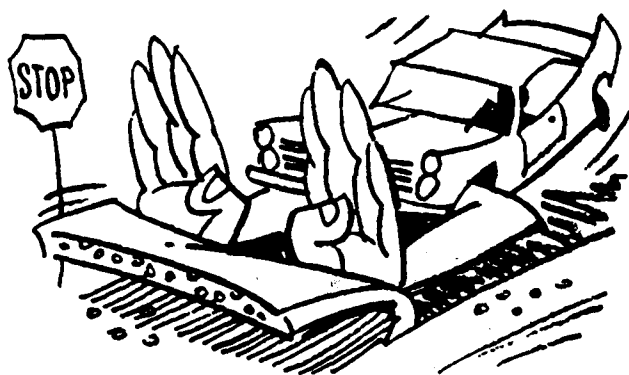
the brake shoe was moved from the outer wheel rim to the inside of an auxiliary rim attached to the wheel, the forerunner of our modern drum-type brake. In the mid-thirties, hydraulic power was added to the drum brake system, providing more stopping power.

THE CHRYSLER RECORD

The cars of Chrysler Corporation have always had a very good reputation in the brake department. Among the more notable systems were our Total Contact Safe Guard, Center Plane, Three Platform and the currently used Servo-Contact brakes. In every case, Chrysler met the need for safe, dependable straight-line stopping. There's no question that our cars have led the industry.

HEAVIER DEMANDS

A recent survey proved that there is an automobile for every 2½ people in America. And, these automobiles are on the move. Every year more people travel more miles, and at higher speeds. The cars are heavier, and they're very often loaded down with vacation gear. A three-hundred horsepower engine is no longer unusual. With all this additional "GO" power, it follows that we also need more "WHOA" power.



—HOW MUCH BRAKE POWER?—

How much braking power is needed in an automobile? Consider the amount of power

required to accelerate a car from a standstill to 60 miles an hour in, say, 15 seconds. Let's assume, for illustration, that it takes 100 horsepower. Now, after the car is moving at 60 miles per hour, it will take an additional 100 horsepower to bring it to a standstill in 15 seconds. As you know, you seldom have 15 seconds to stop. Again for illustration, let's assume that the stopping time is 5 seconds—one-third of the acceleration time. Horsepower is a measurement of work done in a given period of time, and the brakes must do the same amount of work that the engine did, but in one-third of the time. This means that the horsepower requirement is tripled. The brakes exert 300 horsepower in stopping the car.

HEAT ENTERS THE PICTURE

In stopping an automobile, the brake drums and linings absorb a lot of mechanical energy and convert it to heat. For example, stopping a 4,000-pound car from a speed of 60 miles an hour develops about 620 BTU. That's enough heat to raise the temperature of the drums about 170 degrees. Repeated brake applications, such as might be encountered in mountainous country, multiply the heat load. Unless this heat is dissipated rapidly, the linings may deteriorate, the drums become distorted and, in extreme cases, the brake fluid may boil.

DISSIPATION PROBLEMS

Way back when we had 30-inch wheels, getting rid of the heat generated by the brakes wasn't much of a problem. First of all, there wasn't as much heat to get rid of. And, the wheels and drums were well exposed to the air. The heat problem became more severe with the introduction of new suspension systems, which required that the drums be almost encased by the wheels. To add to the problem, more and more sheet metal was installed around the wheels, reducing the flow of air around the drums. Bigger tires, smaller wheels and higher speeds also presented brake heat difficulties, which in turn cause brake fade.

ENTER DISC BRAKES

With the introduction of disc brakes, the heat dissipation problem is greatly reduced. A major portion of the disc is exposed to the air to throw off accumulated heat. The opposing action of the shoes on the disc eliminates dis-

tortion. The absence of distortion permits the use of much greater application force and special lining material with stable friction characteristics, which simply means that the gripping ability of the linings is not affected by temperature extremes.

A GOOD BATH DOESN'T HURT

Even though the discs are exposed to road splash and dirt, the braking efficiency is not affected. Centrifugal force throws most of the water and mud off the disc, and high lining application force and temperature quickly dries the disc and pads. In addition, the pads clean the disc, even when the brakes are not applied. In the unit used on Valiant, Dart and Barracuda, there is only about five-thousandths of an inch clearance between the pads and the disc. In the other unit, the pads actually ride lightly against the disc. A spring behind each piston applies just enough force to keep the pads in light contact, without causing any noticeable drag or lining wear.

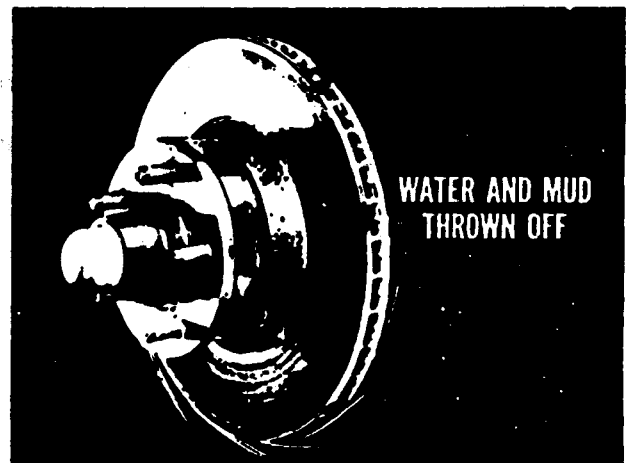


Fig. 1—Discs are self-cleaning

WHY ONLY IN FRONT?

One of the first questions usually asked about our disc brake system is, "Why are discs used only on the front wheels?" As you know, when the brakes are applied, especially in a sudden stop, much of the car weight is thrown forward. So, most of the tire-to-road friction is at the front wheels, where the weight is, and where the most braking power is needed. If an equal amount of braking power were applied to the rear wheels, with less weight on them, they would have a strong tendency to slide, probably resulting in an uncontrolled skid.

MOST BRAKING AT FRONT WHEELS

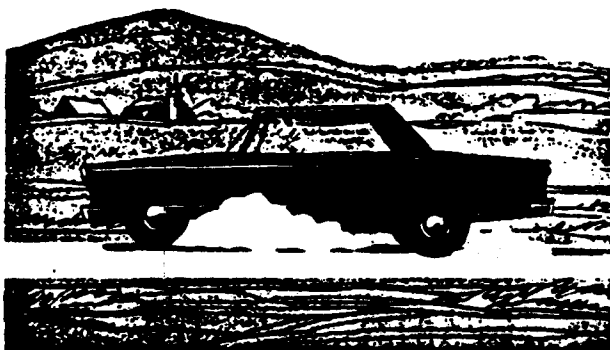


Fig. 2—Most weight is on front wheels

PARKING BRAKES

Another very good reason for using drum brakes on the rear wheels is that drums provide an excellent mechanical parking brake. It would be very difficult to obtain equal results from disc brakes through mechanical linkage.

THE COST FACTOR

It's obvious that disc brakes are more expen-

sive to build than drum brakes. There are four cylinders and pistons per wheel, and the manufacturing tolerances are very close. Since most of the braking force is applied at the front wheels, it would be highly uneconomical to use discs at the rear wheels. Any additional braking power at the rear wheels just wouldn't be worth the extra cost.

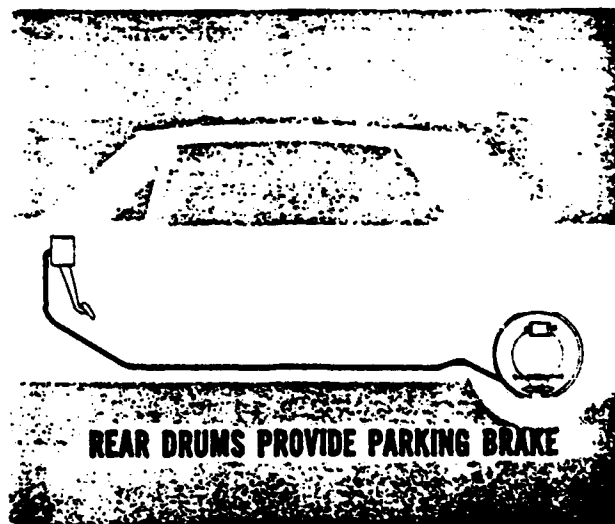
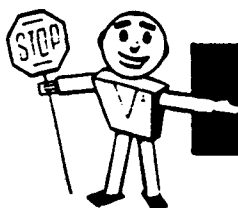


Fig. 3—Drum brakes for parking



DISC BRAKE OPERATION

There are two different disc brake systems available in 1966. The Kelsey-Hayes-type system is used on the Valiant, Dart and Barracuda. The other unit, a Budd type, is used on the Fury, Polara, Monaco and Chrysler. Although they are structurally different, the operation of the calipers is very similar.

THE PARTS

The basic disc brake assembly consists of a hub and disc assembly, a caliper assembly, four pistons and two shoes. The disc is bolted to the hub, and is serviced as an assembly only. The caliper assembly, containing the pistons and shoes, bolts to the steering knuckle and steering knuckle arm, and straddles the

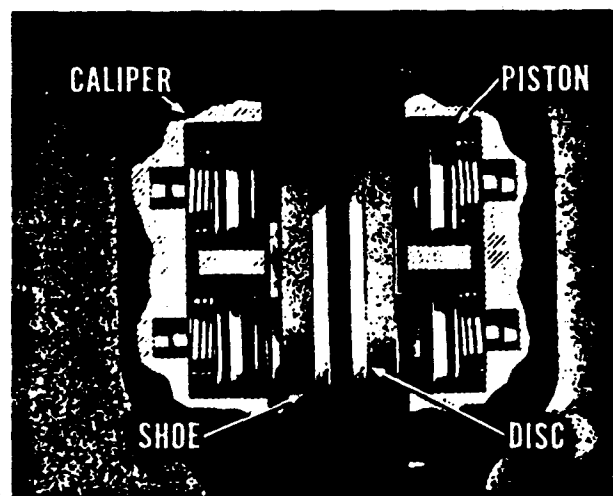


Fig. 4—Disc brake components

disc. The wheels are deep-dished to clear the caliper. The disc has radial ventilating louvers cast between the two contact surfaces. The louvers help to dissipate the extreme heat generated during brake applications.

The high-friction, organic linings are bonded to the steel shoes. There is no provision for adjusting the shoes, since they are self-adjusting. Although the lining area is much smaller than drum-type linings, disc brake linings usually last much longer.

A SQUEEZE PLAY

When the brakes are applied, the pistons force the shoe and lining assemblies against each side of the disc, squeezing it like a clamp or vise. There is an equal force against each side of the disc, so the disc is not distorted by the application, even when the temperature is high, as after repeated applications. Because there is little or no clearance between the shoes and disc when the brakes are not applied, the braking action is instantaneous. The extra-large piston area provides extremely high application force.



Fig. 5—Shoes clamp on the disc

THE HYDRAULICS

Basically, the hydraulics of disc brakes are exactly the same as drum brakes. The master cylinder piston forces the brake fluid into the wheel cylinders and against the wheel pistons. But, in the disc brake systems, each caliper has four large pistons, so the fluid requirement is much larger, and the forces are higher for a given pressure. As an example, on a Fury or a Polara equipped with the standard

drum-type brakes, each front shoe is operated by a single piston with a diameter of 1.375 inches, or an effective area of 1.485 square inches. If the pressure in the brake lines is 1,000 psi, the force each shoe exerts against the drum is 1,485 pounds. On the same cars equipped with disc brakes, each shoe is operated by two pistons of 2.368 inches diameter, or an effective area of 4.404 square inches per piston.

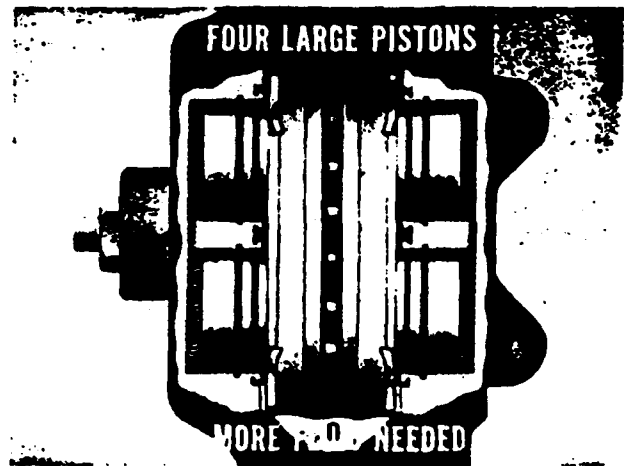


Fig. 6—Higher fluid requirements

If the same pressure of 1,000 psi were introduced into this system, each piston would exert a force of 4,404 pounds against the shoe, for a total force of 8,808 pounds per shoe. This means that each disc would be gripped by a total force of 17,616 pounds!



Fig. 7—More force for same pressure

RESIDUAL VALVE

In a drum brake system, the residual valve

has a very important function. The residual pressure keeps the wheel cylinder cups against the cylinder wall, so no dirt or moisture can enter the system. But, most important, the residual valve makes it possible to pump the brakes when the linings have worn somewhat. Here's how it works.

When the brake pedal is pressed, the master cylinder piston forces the fluid in the cylinder through the residual valve and into the lines. As the pedal is released, the shoe return springs in the wheels force the fluid back out of the wheel cylinders and lines and back into the master cylinder. The residual valve maintains from 12 to 18 psi in the lines by closing when the line pressure drops to the valve capacity. If the brake pedal is pumped, the fluid return will be delayed by the residual valve, and the master cylinder will be refilled from the reservoir, through the compensating port. On the next pedal stroke, this fluid will also be forced into the lines, building up the pedal height.

THE VALVE HAS BEEN MOVED

The residual valve has been relocated for disc brake systems. Residual pressure is highly undesirable in the disc brake calipers. Because of the large diameter of the pistons, and since

there are no return springs in the calipers, residual pressure would cause a heavy brake drag. For example, if there were 18 psi residual pressure in the front wheel cylinders of a Fury or Polara equipped with discs, the shoes would exert 320 pounds of force on each disc. However, residual pressure is still necessary for the drum brakes at the rear wheels. So, the valve is located between the "T" connection and the brake line to the rear wheels.

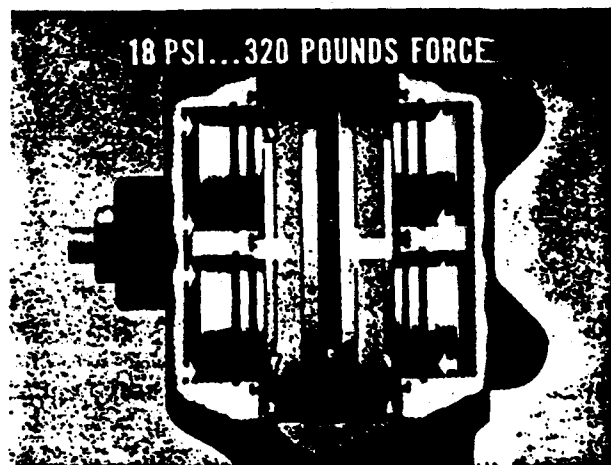
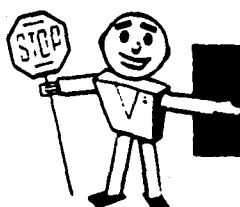


Fig. 8—Residual pressure would cause drag



DIFFERENCES IN THE SYSTEMS

KELSEY-HAYES

The Kelsey-Hayes-type unit, used on the Valiant, Dart and Barracuda, has $1\frac{5}{8}$ -inch-diameter pistons. Each lining has $8\frac{1}{2}$ square inches of braking surface. The rear wheels have 10-inch brakes, with $1\frac{3}{4}$ -inch-wide linings. Fourteen-inch wheels are used with this disc brake system.

When the brakes are applied, the four pistons press the shoes against either side of the disc. The square piston seals, in the walls of the cylinders, move slightly with the pistons. When the brakes are released, the elasticity of the seals pulls the pistons back away from the shoes about five thousandths of an inch.

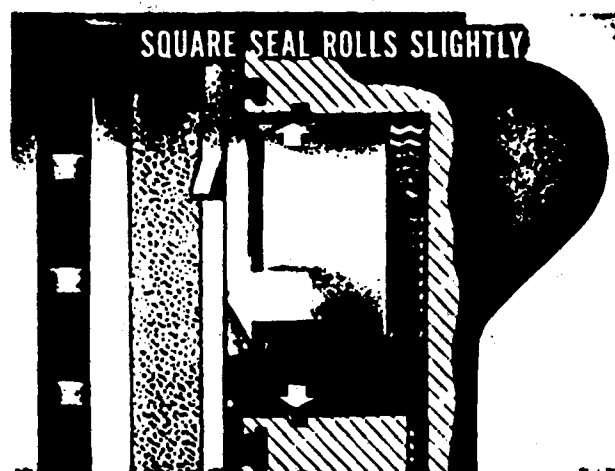


Fig. 9—The piston rolls the seal

This allows any small amount of lateral run-out in the disc to tap the shoes away from the contact surfaces, providing the running clearance. Anti-rattle springs in the caliper splash shield hold the shoes in the unapplied position. Two small ears on the ends of the shoes support them in the caliper. The ears ride on notches, called bridges.

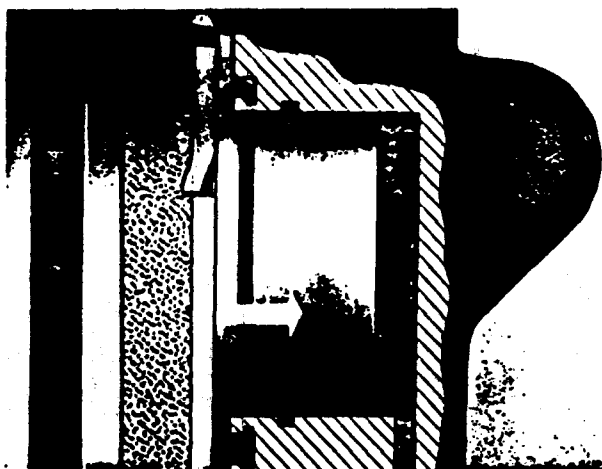


Fig. 10—The seal pulls the piston back

THE PISTONS

The pistons in this unit are cup-shaped, with the open end contacting the shoes. The cup-shaped construction minimizes the transfer of heat from the shoes to the fluid. Otherwise, the fluid could get hot enough to boil, creating bubbles, which would cause a spongy brake pedal.

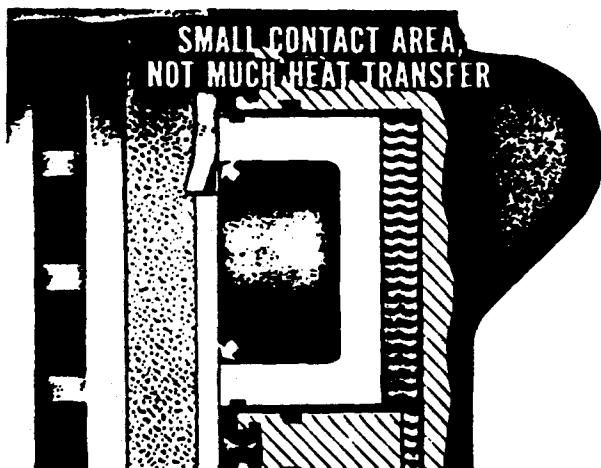


Fig. 11—Hollow pistons don't conduct heat

THE HYDRAULICS

Probably the first thing you'll notice about

the hydraulic system is the extra capacity of the master cylinder reservoir. The four large cylinders in each caliper need a lot of fluid as the linings wear down.

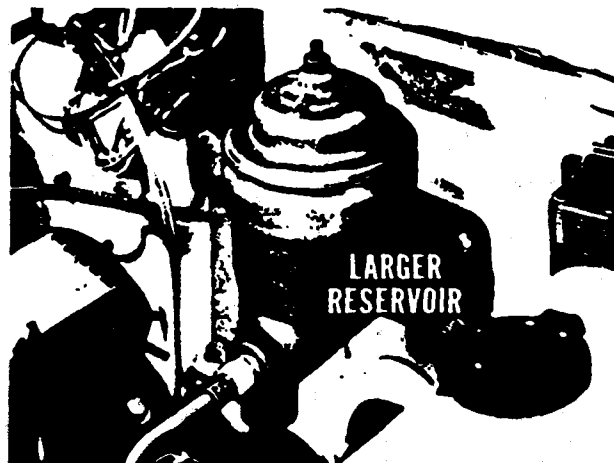


Fig. 12—A bigger fluid supply

THERE'S ANOTHER VALVE

Another difference that will be immediately apparent, in the Kelsey-Hayes-type unit, is a second valve. It's called a proportioning valve, and it's located after the residual valve in the line to the rear brakes. Its purpose is to provide maximum braking at all four wheels before any wheel begins to slide, under any road conditions. It performs this function by regulating the hydraulic pressure to the rear wheel cylinders during heavy brake applications.

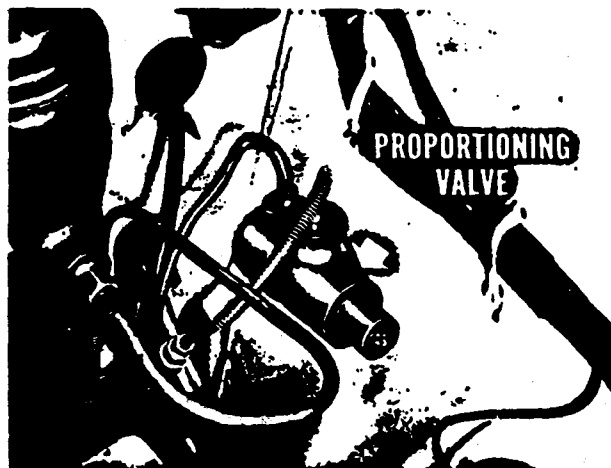


Fig. 13—Valve limits rear cylinder pressure

WEIGHT DISTRIBUTION

During light brake applications, hydraulic

pressure seldom exceeds 300 psi. Under these light braking conditions, the weight differential between front and rear wheels is much less than during heavy applications, so a larger percentage of the braking force can be applied to the rear wheels without fear of sliding the rear wheels. However, as brake application increases in intensity, more weight is thrown onto the front wheels, and correspondingly less on the rear wheels. So, the greatest force must be applied to the front wheels. And, although the piston area in the disc front brakes is much greater than in the rear drum brakes, remember that the discs have a much smaller lining area.

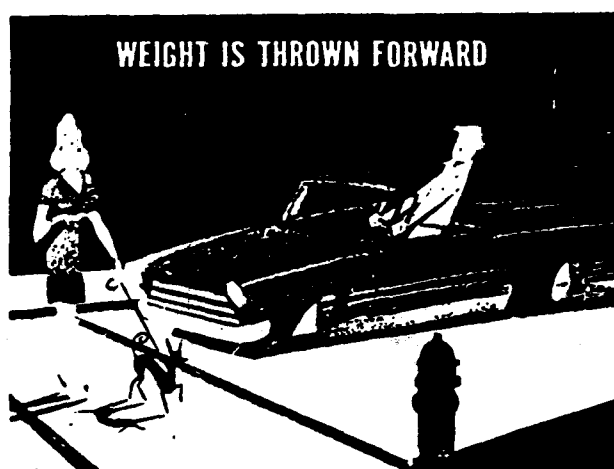


Fig. 14—Weight distribution is important

THE PRESSURE LIMIT

To demonstrate the function of the proportioning valve, let's assume some braking applications of different intensities. First, a light application, with up to 300 psi line pressure from the master cylinder. This would be typical of a gradual stop at an intersection in a residential area. As mentioned before, there isn't much weight differential between front and rear wheels, so equal pressure is supplied to all four wheels.

A traffic light that changes unexpectedly presents a good example of a moderately heavy brake application, with perhaps 600 psi line pressure from the master cylinder. This puts a higher percentage of the car weight on the front wheels, so the braking force required at the rear wheels will be proportionately less than at the front. The proportioning valve al-

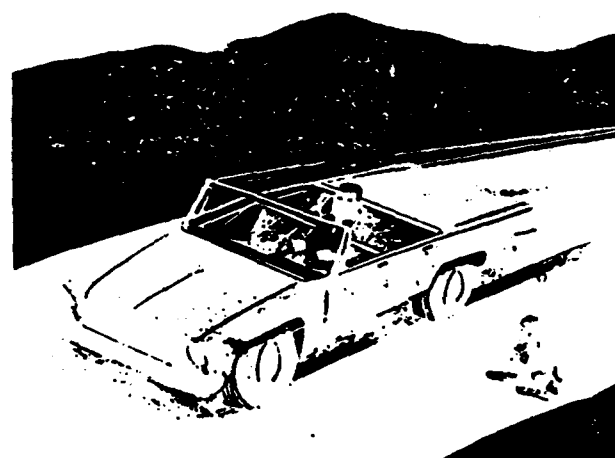


Fig. 15—Moderately heavy stop

lows only 450 psi to the rear cylinders, even though the caliper cylinders get the full 600 psi.

When that crazy driver pulls out of a stop street without looking, you have to really clamp down on the stoppers. Again, the weight shift is greater, so the braking proportion changes, too. Let's say you're standing on the pedal, and producing 900 psi master cylinder pressure. You sure don't want that much pressure at the rear wheel cylinders, so the proportioning valve cuts it down to 600 psi.

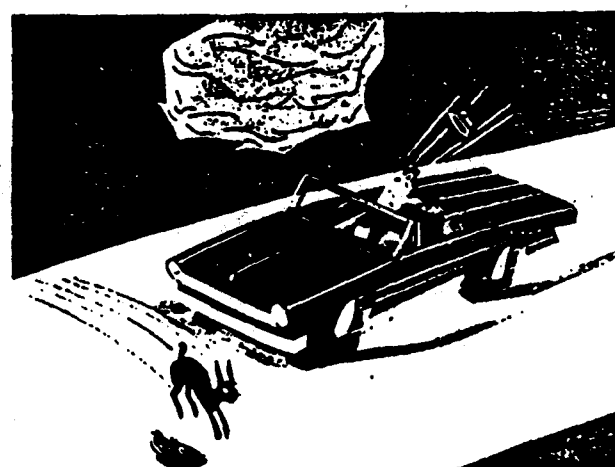


Fig. 16—A panic stop

OVER 300 PSI, REDUCES 50%

As you can see by the examples given, at pressures of 300 psi or less, the proportioning valve doesn't do a thing for us. When pressures go higher than 300 psi, the valve allows the 300 to the rear cylinders, but anything greater than

that amount is reduced by 50%, as shown in the following chart.

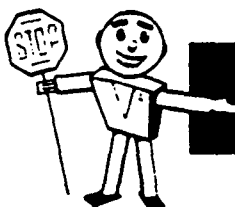
LINE PRESSURE	REAR PRESSURE
300	300
500 (300 - 200)	400 (300 - 100)
700 (300 - 400)	500 (300 - 200)
900 (300 - 600)	600 (300 - 300)

INTER-CYLINDER SUPPLY

Even though there are four large cylinders in each caliper assembly, there is a single hydraulic feed line to the bottom cylinder in the inner half of each caliper. The top cylinder in the inner half is supplied through a cored passage in the casting. The cylinders in the outer caliper half are supplied through a transfer tube from the inner half.



Fig. 17—Tube supplies outer caliper half



SERVICE INSTRUCTIONS AND PRECAUTIONS

SERVICING KELSEY-HAYES

Disc brake linings on the Valiant, Dart and Barracuda should be replaced when they are worn to the point where the combined thickness of the shoe and lining is $\frac{3}{16}$ -inch or less. Inspection and replacement of the shoes is very simple. Just remove the front wheel and the caliper splash shield anti-rattle spring assembly. You should be able to measure the shoe and lining thickness while they're in the

caliper. If not, simply pull them out of the caliper for measurement.

WARNING SIGNAL

When a Valiant, Dart or Barracuda has accumulated a lot of mileage, the customer may complain of a scraping noise when the brakes are applied. The noise is probably caused by signal tabs in the brake shoe. They are stamped into the shoe to act as a signal to the driver



Fig. 18—Time to replace linings

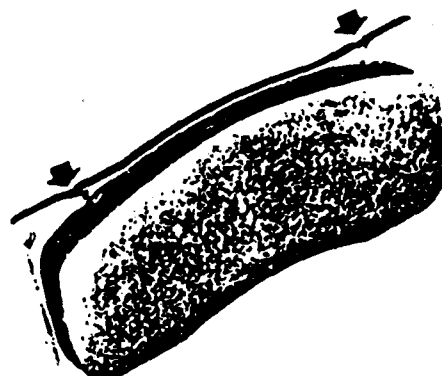


Fig. 19—Tabs signal worn out shoes

when the linings are worn down to the danger point. When the brakes are applied, the tabs contact the disc to produce the scraping sound. This won't affect the braking or harm the disc, provided the linings are changed within a short length of time.

LINING REPLACEMENT

To replace the linings in the Kelsey-Hayes unit, remove the wheel and the caliper splash shield anti-rattle assembly and pull the worn linings out through the splash shield opening. You'll find that two pairs of pliers make it a little easier to grip the shoes. Always inspect the caliper carefully for signs of fluid leakage.

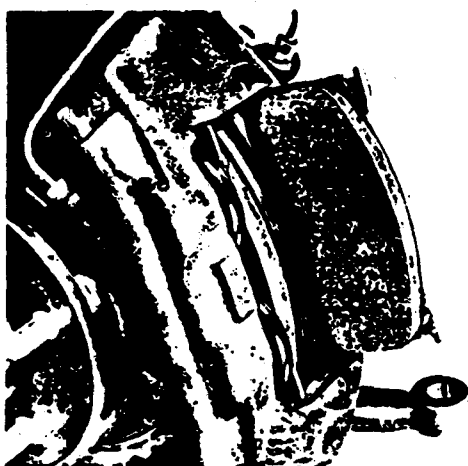


Fig. 20—Shoe replacement is an easy job

You may need to remove the caliper for seal replacement. To install the new shoe and lining assemblies, force all four pistons back into their bores and simply drop the new shoes into the caliper through the splash shield opening.

DRAIN SOME FLUID

As the brake linings wear down, it takes more fluid to fill the cylinders. Since there are four large cylinders at each front wheel, and there is about $\frac{3}{8}$ -inch difference between the thickness of a worn lining and that of a new lining, you can see that a lot of fluid can be added to the reservoir during the lining wear period. When you try to force the caliper pistons back into their bores, this extra fluid has no place to go. So, before installing new linings, drain most of the fluid from the master cylinder reservoir. Just be mighty careful not to get any dirt in the reservoir. When the new shoes

are installed and you have a firm pedal, refill the reservoir with new brake fluid.



Fig. 21—Fluid level should be checked often

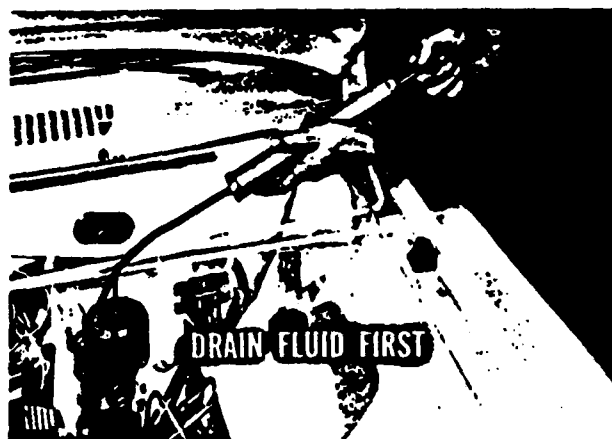


Fig. 22—Make room for fluid in the calipers

BLEEDING

The bleed screw on Valiant, Dart and Barracuda disc brakes is located at the top of the

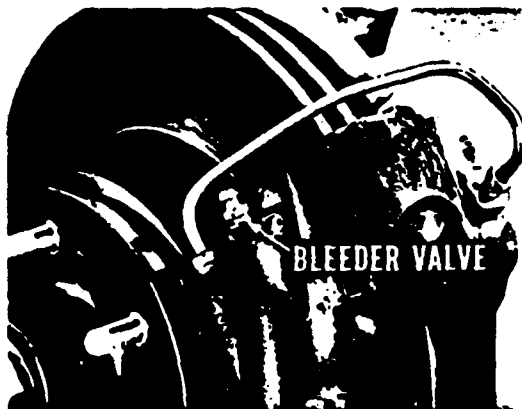


Fig. 23—Remove the wheel to bleed caliper

outer caliper half, so you'll have to remove the wheel to bleed the calipers. And, don't forget that you'll have to add more fluid on disc-brake cars than on drum-brake cars. Our present pressure bleeding tank adapters are not compatible with the "piggy back" reservoir, but a new adapter cover is currently being developed to handle both disc brake systems.

CAUTION: Always discard fluid drained from the hydraulic system during the bleeding operation. It must never be re-used.

PROPORTIONING VALVE TEST

If you get a rear wheel slide on a Valiant, Dart or Barracuda, it's possible that the proportioning valve is not reducing the pressure to the rear wheel cylinders. You can check the valve operation with gauge set C-4007, consisting of two 1000-psi gauges with high-pressure hoses and two "T" connectors.

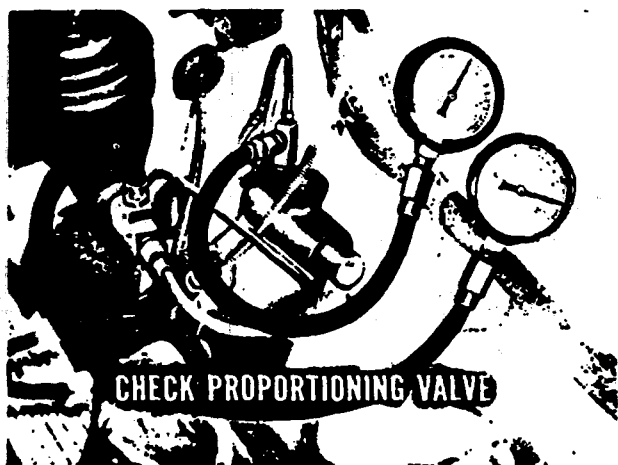


Fig. 24—Proportioning valve must reduce pressure

Install one "T" and gauge between the master cylinder and the master cylinder line. The other "T" and gauge goes between the proportioning valve outlet and the rear brake line. Draft someone to help you, and have him push the brake pedal hard enough to produce 800 psi on the master cylinder gauge. With the master cylinder gauge holding steady at 800 psi, the proportioning valve gauge should read between 540 and 560 psi. If it's outside the specification, replace the valve.

You may have difficulty getting 800 psi at the master cylinder gauge if the gauge hose is full

of air. If so, bleed both of the gauge hoses at the gauge end to remove the air. Remember, air is compressible, and the master cylinder piston stroke is not very long. And, you can't pump up the pressure in the master cylinder gauge, because there is no residual valve in the master cylinder. When you're finished with the test, cap the gauge hoses to keep the fluid from draining out, so you won't need to bleed them on the next job.

BUDD TYPE

The Budd-type unit, which is optional on the Fury, Polara, Monaco and all the Chryslers, has 2.368-inch-diameter pistons. Each lining has about 10 square inches of braking surface. The wheels used on these cars are 15-inch 6K, and the rear brakes are 11 inches, with 2½-inch-wide, heavy-duty police linings.

NO CLEARANCE

The major mechanical difference between this disc brake unit and the Kelsey-Hayes-unit is lining clearance. In the Budd unit, the linings actually ride lightly against the disc, even when no braking pressure is applied. Each piston has a spring behind it. The springs provide the light contact between linings and disc. The light contact helps to keep the disc clean and dry.



Fig. 25—Shoes keep the disc clean

THE PISTONS

The pistons used in the Budd unit are narrow, with a piston guide on the inner end to prevent them from "cocking" in the cylinder. The piston seal groove is in the piston itself, rather

than in the cylinder, as in the other unit. There's a heat insulator pad on the outer end of the piston to prevent braking heat from reaching the brake fluid.

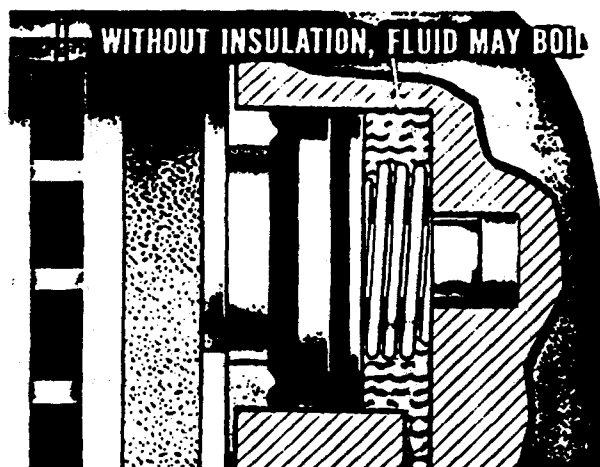


Fig. 26—Insulator keeps the piston cool

THE HYDRAULICS

There is no external transfer tube to feed fluid to the cylinders in the outer caliper half. Instead, the fluid transfer is through cross-over passages cast into the caliper halves. There's an "O" ring seal at each of the cross-over passages to prevent leakage. The bleed screw is located at the top of the inner caliper half, so it's accessible without removing the wheel.

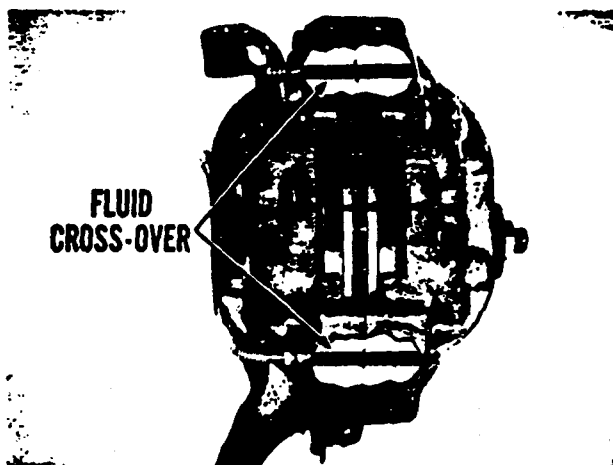


Fig. 27—Passage supplies fluid to outer-half

ONLY ONE VALVE

You won't find a proportioning valve on these larger cars. That's because the rear wheel cylinders are only $\frac{7}{8}$ -inch in diameter, as com-

pared to 2.368 inches in the calipers. With the area proportion between front and rear wheel cylinders, we can use the same hydraulic pressure all the way around. The system does have a residual valve, though. It's located under the left side of the car, near the front edge of the front door.

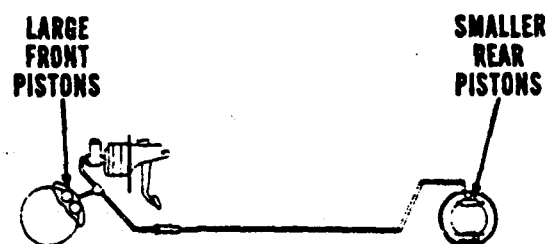


Fig. 28—No proportioning valve needed

LINING INSPECTION

If the disc brake linings on a Fury, Polara, Monaco or Chrysler are worn down to $\frac{1}{32}$ -inch, it's time to replace them. To check for lining wear, simply raise the front of the car and remove the wheel. The linings are visible through the top of the caliper.



Fig. 29—Maximum lining wear

LINING REPLACEMENT

To replace the linings on these cars, you'll have to remove the caliper from the disc. How-

ever, there's no need to break into the hydraulic system unless inspection shows the need for further repairs. First, remove the anti-rattle spring from the caliper and shoes. Then, remove the two caliper attaching bolts from the steering knuckle and steering knuckle arm.

Lift the caliper assembly off the disc, but be very careful not to put a strain on the caliper tube or the flex line. Support the caliper assembly solidly and remove the shoes from the housing. The steering tie rod is a handy place to lay the caliper while you check for any signs of fluid leakage.

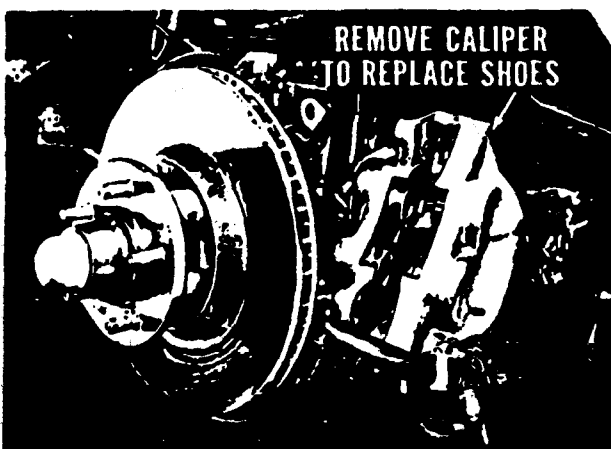


Fig. 30—It's not necessary to open hydraulic lines

SPECIAL TOOL NEEDED

A special tool, C-3992, is used to compress the caliper pistons when the new shoe and lining assemblies are being installed. First, place the new shoe in position in the caliper. Then, insert the compression tool between the lining

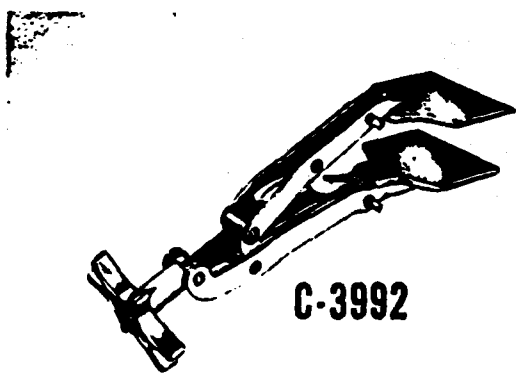


Fig. 31—Forces pistons back into the bores

faces and turn the knob to force the pistons back into their bores.

NOTE: Be sure to drain some of the fluid from the master cylinder to make room for the fluid in the caliper cylinders.

With the tool in place, slide the caliper down over the disc. As the caliper slides into position, the disc will force the compression tool out from between the linings. Install the two attaching bolts and tighten them at 70 to 80 foot-pounds. Install the anti-rattle spring through the shoe tabs and snap it into place in the grooves in the caliper. Refill the master cylinder and make sure you have a firm pedal.

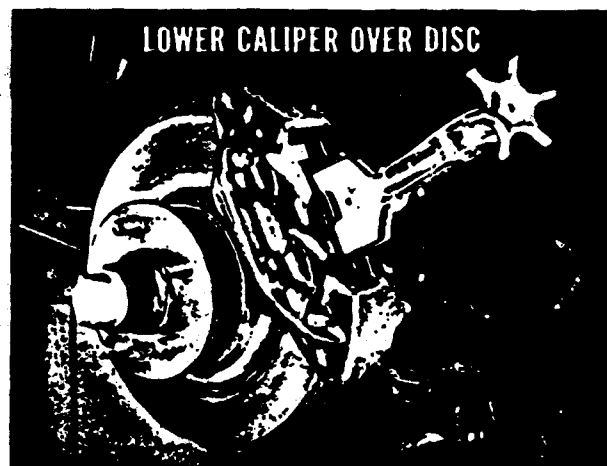


Fig. 32—The disc forces the tool out

— GENERAL SERVICE INFORMATION —

SEAT NEW LININGS

When new linings have been installed in either type of disc brake, the car may have a tendency to pull to one side or the other during the first few brake applications, because of small variations in the linings. If you make a few quick stops from about 40 miles an hour, the linings will seat themselves and eliminate the pull.

DON'T REFACE DISCS

If you suspect that a disc has a lot of lateral runout, or "wobble", check it with a dial indicator. Maximum allowable runout is .0025 inch on the Kelsey-Hayes disc and .005 inch on the Budd disc. If runout exceeds these specifications, the hub and disc assembly must be replaced. **DO NOT ATTEMPT TO REFACE A DISC.**

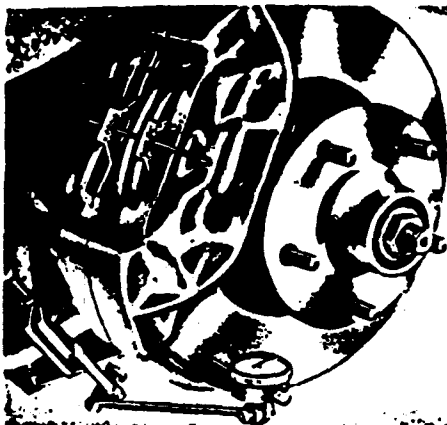


Fig. 33—Check lateral runout of disc

BEARING SERVICE

It is not possible to remove the wheel and hub as an assembly. If you have to service front wheel bearings, you must first remove the wheel to gain access to the caliper. After the caliper is removed, then the hub and disc are removed as an assembly.

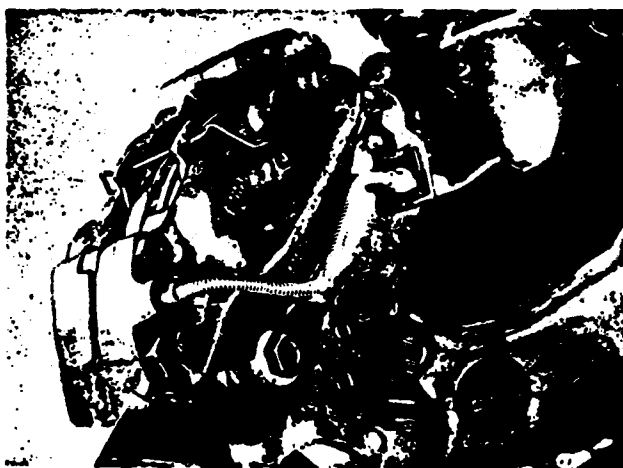


Fig. 34—Remove wheel first

OTHER SPECIAL TOOLS

There are two other special tools in addition to the proportioning valve gauges (C-4007) and the piston compression tool (C-3992). A piston remover, C-3999, is used on the Kelsey-Hayes unit to remove the pistons from the caliper. It's very difficult to get the pistons out without the tool, since the square seal rolls with the piston and grips it. The other tool, C-3993, is a caliper cylinder hone, which is used on both units. If a cylinder gets a light scratch, the seal might be damaged, causing a



Fig. 35—Used on Valiant, Dart and Barracuda

leak. The hone will clean up the scratch, but you should never remove more than .002 inch from the cylinder. Always install the hone baffle to avoid damaging the stones when they hit the bottom of the bore.

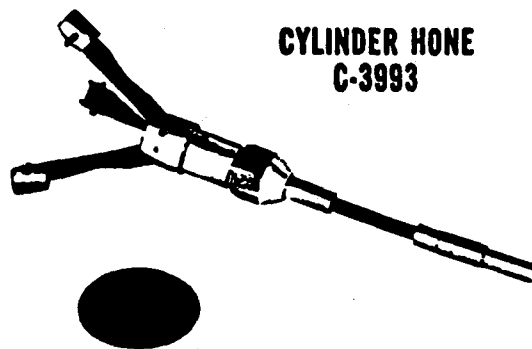


Fig. 36—Cylinder hone for both calipers

BRAKE FLUID

There are many brake fluids on the market with a variety of specifications. They are not all compatible with Chrysler Corporation brake systems. So, play it safe. Use only Chrysler-approved HiTemp brake fluid, with an SAE 70R3 rating.

POWER ASSIST

The Fury, Polara, Monaco and Chrysler disc brake installations include a dual diaphragm power booster as standard equipment. A single diaphragm power booster is optional with the Valiant, Dart and Barracuda disc brakes. Service on these two boosters is very well covered in your 1966 Service Manual.

REFERENCE BOOK **67-4**

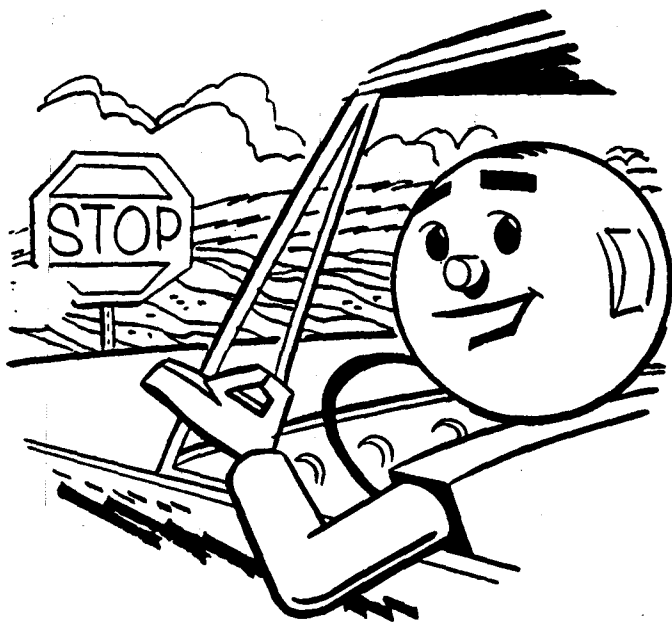
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Disc brakes are still newcomers to the automotive scene, so maybe you haven't worked on too many of them so far . . . especially since disc brake linings usually last a long time, and the brakes themselves are simple and sturdy.

In most cars, disc brakes are an extra-cost option, and the owner who drives mostly in city traffic probably won't feel the need for their heavy-duty braking action. However, disc brakes are becoming a popular item for cars driven frequently on superhighways or hilly roads, and on heavily loaded station wagons.

At any event, the trend is definitely toward more cars with disc brakes. In fact, they are standard equipment on the Imperial models for '67. Right now, you can be sure of one thing . . . disc brakes are here to stay.

You'll find that disc brake servicing is easy . . . an ordinary lining replacement job takes only a few minutes for each brake. However, you'll need a thorough Master Technician's knowledge of these new brakes to do a good overall job of troubleshooting and servicing.

Be sure to review this reference book and keep it handy for quick reference on the job. Remember, a car's safety features are built in at the factory, but they depend on your know-how to keep them working properly.

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INTRODUCTION

Increasing numbers of buyers are ordering their new cars equipped with disc brakes. Most of them expect to drive their cars part or full time under highway conditions which make overheating and fading a serious problem with regular drum-brake systems.

These drivers know from experience that drum brakes do a good job in everyday driving conditions such as stop-and-go city traffic, repeated slowdowns on expressways, or a couple of stops from high speed, one after the other. However, they also know that the fade-resistant feature of the disc brakes gives them important safety advantages in other driving situations where repeated hard brake applications and severe stops from high speeds are common.

NOW THERE ARE THREE

Three designs of disc brakes are available on 1967 Chrysler Corporation cars. The disc brake used on compact models is a Kelsey-Hayes type, and on intermediate-size models, it's a Bendix. The larger car models use Budd-type disc brakes.

All except the compact-model disc brakes are designed to be used with a power booster unit. The Kelsey-Hayes disc brake system is available either with or without the new dual-diaphragm power unit. On cars without the power unit, you'll notice that disc braking takes more pedal pressure than with the standard drum brakes all around.

BRAKE FADE FACTS

The well-known symptoms of brake fading are repeated here to make the disc brake story complete. Experienced drivers know that car brakes are failing when the brakes seem to "slip" and heavy pedal pressure is needed to stop the car. Where fading occurs, the pedal loses its normal feel and becomes quite hard when the extra pressure is applied. And, even with heavy pedal pressure, the brakes don't seem to have much stopping effect.

The driver also notices that the pedal must be pushed down farther than usual after repeated heavy brake applications.

REASONS WHY THEY FADE

Brake fading results from heat generated by braking friction. In normal, everyday use, brakes get a chance to cool off between applications so fading is no problem. However, if the brakes are applied hard several times in a row, brake temperature can build up and cause fading. A long downhill brake application will also do it, especially in the heavier models.

One reason why drum brakes overheat and fade more easily than discs is that their relatively large lining contact surface produces heat all around the drum when the brakes are applied. With disc brakes, the smaller lining surface limits heat production to the friction area in the calipers and as the discs revolve, they carry heat away from the linings.

Both drum and disc brakes can fade if braking conditions are severe enough, but disc brakes can get rid of heat faster, so they are more fade-resistant than drum brakes.



Fig. 1—Overheating causes brake fade

WHAT HAPPENS IN A FADE

When brakes overheat, the lining loses some of its friction efficiency so the shoes must press harder against the drum or disc to produce enough braking action to stop the car. With drum brakes, this friction loss also reduces the normal self-energizing effect so still more pressure must be applied to the pedal. Disc brakes are not self-energizing, so they are not affected in this manner.

FADING CAN BE ONE-SIDED

Drum brake self-energizing action can also cause uneven braking if the heat-induced friction loss in the brake on one side differs from the other. It's easy to see that the car will pull or swerve toward the side that has the greatest braking power.

DRUMS STRETCH AND DISTORT

When hard brake applications build up drum temperature, the drum expands and becomes flexible. And, because the pedal must be pushed down harder when fading occurs, the added brake shoe force stretches the drum out of round. Where this happens, continued pedal pressure moves the shoes out farther to maintain the braking contact, and the pedal itself moves closer to the floor.

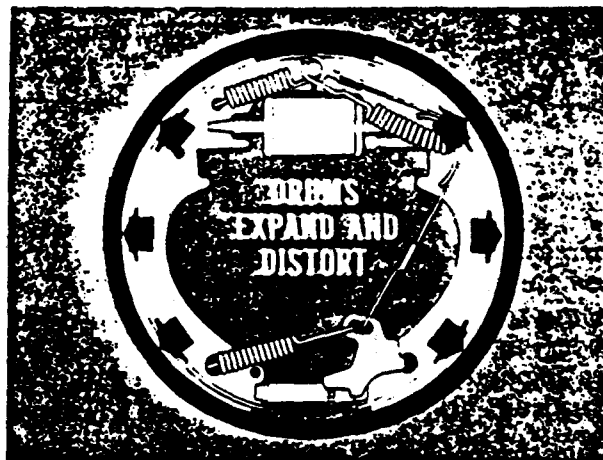


Fig. 2—Brake shoe force distorts drums

DISCS PLAY IT STRAIGHT

With disc brakes, heat expansion and shoe forces work the opposite way. When the brakes are applied, disc friction surfaces expand toward the brake shoes instead of away as in drum brakes.

There's no distortion problem either, because the shoes press inward against solid surfaces on both sides of the disc instead of pushing outward to stretch and distort a drum made flexible by overheating.



THE DISC BRAKING SYSTEM

The three designs of disc brakes available on '67 Chrysler Corporation cars differ in details but are similar in general construction and operating principles. Regular drum brakes are used in the rear of all three systems.

Disc brakes are used at the front wheels to put the most braking power and fade-resistance up front where traction is greatest in a hard stop. In such stops, rear braking loads are somewhat lighter, so comparatively less braking power and fade-resistance are needed. Therefore, the less expensive drum-type brakes can be used at the rear wheels.

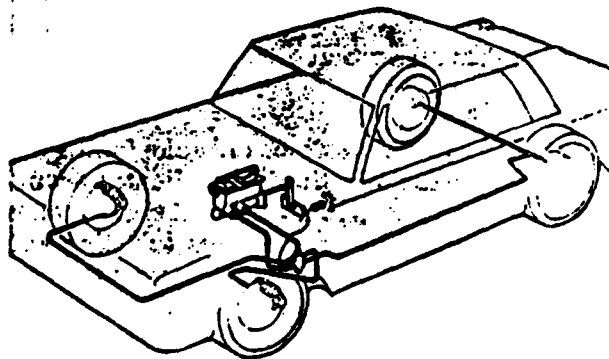


Fig. 3—Disc and drum braking is proportional

BRAKING IS PROPORTIONAL

This disc and drum arrangement takes advantage of the fact that stopping shifts the car's weight balance forward in proportion to the braking forces. In other words, a hard stop produces more traction between the front tires and the pavement than at the rear. In an easy stop, the weight shift is moderate, so traction remains nearly the same at front and rear.

Besides adequate rear braking capacity and lower cost, drum brakes also provide a simple and effective mechanical parking brake system. To produce similar results with a disc brake parking system would require a very complicated leverage system because very high pressure is needed between the shoes and discs.

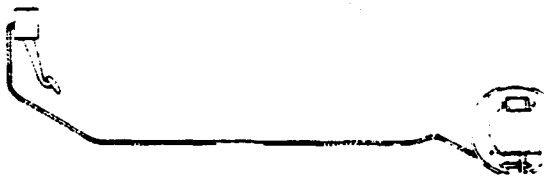


Fig. 4—Drums provide parking brake

DISC BRAKE PARTS

Main disc brake components are the disc and caliper assemblies. The caliper straddles the disc so that brake linings on both sides can grip the disc between them when the brake pedal is pushed down.

On the car, the caliper assembly bolts to the steering knuckle so that it straddles the upper rear section of the braking disc. This location helps protect the caliper and linings against road damage. The brake is also protected by an inner splash shield and the hub section of the wheel.

CALIPER DETAILS

The caliper assembly includes four hydraulic

pistons and two brake shoes, with a pair of pistons and a brake shoe on each side of the disc.

Each piston is provided with a seal to keep fluid in and a dust boot to keep dirt out. The Kelsey-Hayes piston seals also act as retractors to pull the pistons back a small distance when pedal pressure is released. Under the same conditions, the Bendix and Budd pistons are moved out by springs to keep the brake linings in light contact with the disc.

DISC DETAILS

The cast-iron braking disc has a flat-ground friction surface on each side with open-end air-cooling passages between the two surfaces. The disc is solidly attached to the wheel hub. They are both serviced as a complete unit because they are machined as a complete assembly.

FORCE-FEED COOLING

Centrifugal force draws air into the disc cooling passages at the inner section of the hub and discharges it at the openings around the rim of the disc.

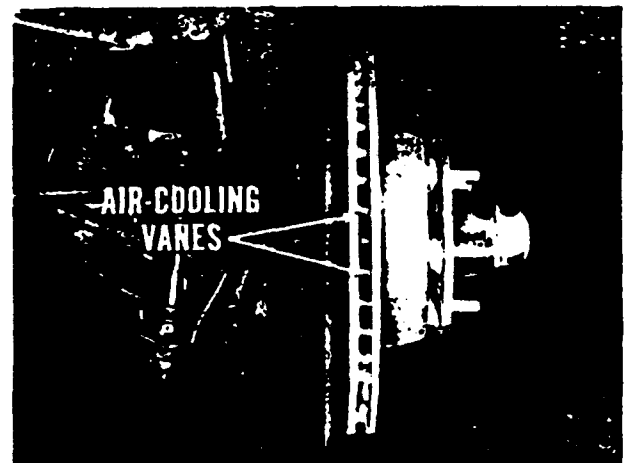


Fig. 5—Air flow cools brake disc

Air flow through the disc passages helps to keep brake operating temperature below the fade point even though disc brake linings normally run hotter than drum linings. Also, the biggest part of the disc is always exposed to surrounding air. So, when the disc rotates and passes through the high-temperature area between the shoes, it carries heat away from the linings.

NO WET-BRAKE PROBLEMS

The open disc design and high shoe temperatures also help disc brakes to dry out faster than drum types. A rotating disc can easily spin water out of the brake instead of holding it in like a close-fitting drum. The high lining operating temperature quickly dries out the shoe friction surfaces so braking action of flooded brakes is fully restored very quickly.



Fig. 6—Rotating disc reduces lining temperature

DISC BRAKE LININGS

Disc braking action depends on direct brake lining force against both sides of the disc. And, since disc brakes are not self-energizing and their lining area is smaller, brake shoe application force must be considerably higher than in drum brakes.

Because its area is smaller, disc lining material is made harder so it can resist compression by the high piston force needed to produce braking action. These linings can also stand more heat

and are therefore more resistant to fading. As a result, you get more consistent braking action and pedal feel in all kinds of stops.

LININGS RESIST COMPRESSION AND FADE

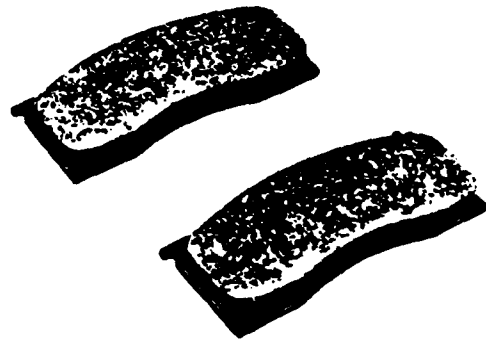


Fig. 7—Hard disc linings fight brake heat

LININGS LAST LONGER

In spite of the relatively small lining area and high application forces, disc brake linings usually last a lot longer than drum linings. Of course, as with drum linings, disc brake lining life depends on how hard the car is driven and the severity of the brake applications. Extra-hard usage such as police pursuit work or competition driving will cause rapid wear with any regular brake system.

THEY'RE NOT FOR DRUMS

We might mention here that the hard, fade-resistant disc brake linings are not used in drum brakes because much heavier pedal pressure would be needed to apply the brakes. Added to this is the fact that hard linings do not produce much self-energizing action.



DISC BRAKE HYDRAULICS

As with drum brakes, hydraulic pressure in a disc brake system is equal at all pistons. So, when brakes are applied, the pistons push the

brake shoes inward against the disc with equal force on both sides.

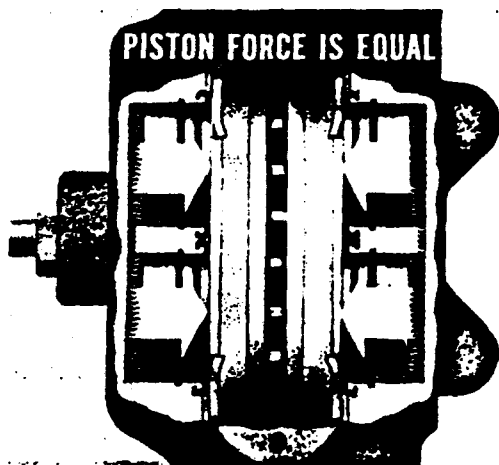


Fig. 8—Equal piston force prevents disc distortion

And, since piston force is equal on both sides, the braking disc cannot be forced out of shape no matter how much pressure is applied at the brake pedal.

ALWAYS READY FOR ACTION

In normal operation, the brake shoes remain close to the disc when brakes are released. With no pedal pressure applied, the linings of Kelsey-Hayes brakes can retract slightly, while Bendix and Budd linings remain in light contact with the disc surfaces.

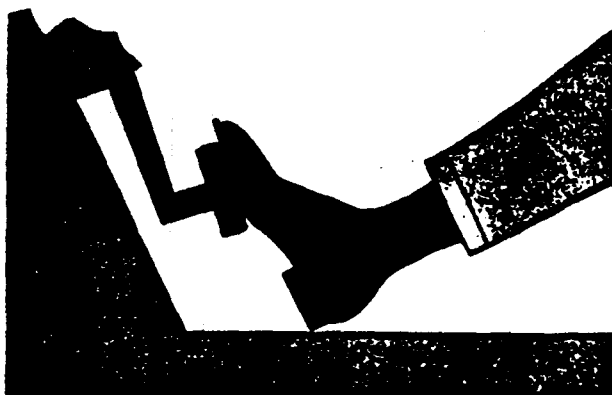


Fig. 9—Pedal riding causes lining wear

This means that braking action is practically instantaneous when your foot pushes the pedal down. It also means that only slight foot pressure on the pedal will partly apply the brakes

and cause linings to wear rapidly. So, the driver who uses the brake pedal as a footrest will have to change this habit or be prepared to spend money for a premature relining job.

MORE PISTONS NEED MORE FLUID

As we mentioned earlier, each disc brake caliper assembly has four hydraulic pistons, two on each side. Besides having more pistons than a drum brake, the pistons are also much larger and need more brake fluid to operate them.

IT TAKES MORE FORCE TO STOP

The main reason why a disc brake has more and larger pistons is that it takes more force at the shoes to get the braking action needed to stop the car. And, as you already know, disc brakes need more application force because they are not self-energizing and their linings are relatively small.



Fig. 10—Disc brakes need high application force

Using the Kelsey-Hayes disc brake as an example, we find that each piston has an effective area of 2.107 square inches. Now, assuming that hydraulic system pressure is 1,000 pounds, each piston will exert a 2,107-pound force to produce a total gripping force of 8,428 pounds on the disc.

DRUMS HAVE IT EASIER

Compared with disc brakes, the standard front drum brake for the same model car has only two hydraulic pistons, each with an effective area of about one square inch. If we have the

same hydraulic pressure as before, brake shoe force against the drum is only 1,000 pounds at each piston.

ADJUSTMENT IS AUTOMATIC

Besides being smaller than drum shoe lining, disc brake lining is much thicker, measuring about a half-inch when new. Because the linings remain close to the disc when the brakes are released, the pistons gradually move out of their bores as the lining wears thinner. This, in effect, makes the disc brake shoes automatically self-adjusting.

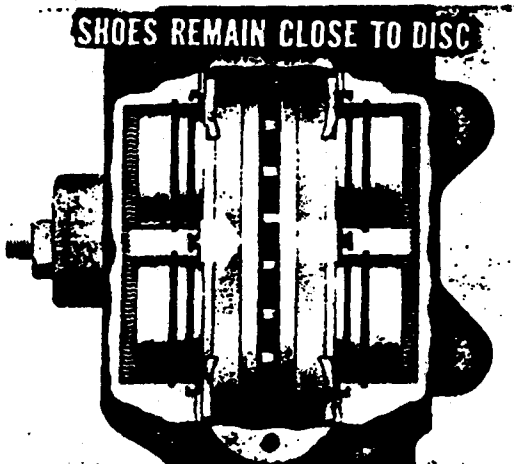


Fig. 11—Disc brakes adjust automatically

MORE REASONS FOR MORE FLUID

However, as the caliper pistons move outward to compensate for lining wear, more fluid is drawn from the master cylinder reservoir to keep the space filled behind each piston. So, the master cylinder used with disc brakes has larger reservoir capacity than a drum brake master cylinder for two reasons: To keep the system filled as the pistons adjust to lining wear, and provide the greater fluid volume needed to operate the eight large pistons.

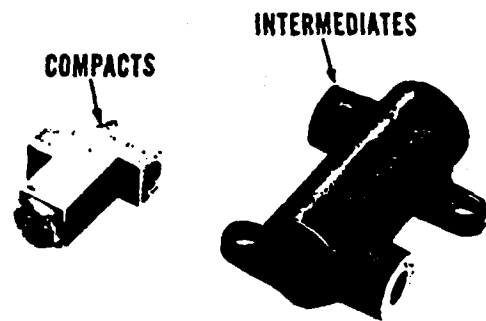
DRUMS ARE DRUMS, HOWEVER . . .

As mentioned earlier, the rear brakes in our disc brake systems are drum-type because they do an adequate job of braking at the rear wheels and cost less than disc brakes. They also provide a simple, mechanical parking brake system.

You'll notice that the rear brake hydraulic system is the same as that used with the standard drum brake system with one exception—compact and intermediate-size models have a proportioning valve in the hydraulic line that leads to the rear brakes.

THEY WORK IN PROPORTION

The proportioning valve design is slightly different for each car group, but both valves do the same job of controlling hydraulic pressure to the rear brakes, so the same operating principles apply to each.



VALVE DESIGN IS DIFFERENT

Fig. 12—Proportioning valve controls rear brakes

PROPORTIONING VALVE OPERATION

To properly understand proportioning valve function, let's review disc brake system operation. First of all, you know that discs need more brake-shoe pressure than drum brakes to get the same amount of braking action. However, on compact and intermediate-size models, the proportional area of front and rear brake pistons is such that equal hydraulic pressure at all four brakes will produce balanced braking action for average stops.

THAT WEIGHT SHIFT AGAIN

You'll remember that the forward weight shift is moderate in easy stops, so car weight and traction are evenly distributed. But, since this shift is substantial in hard or severe stops, traction at the rear wheels is reduced in proportion to the weight shift.

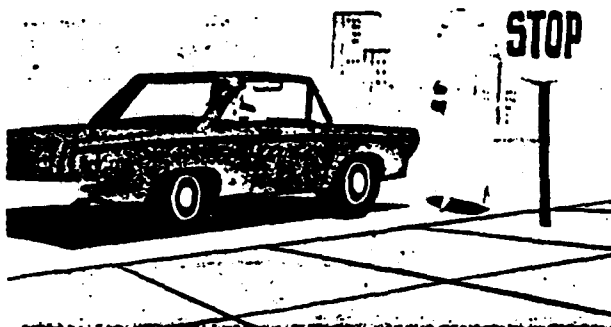


Fig. 13—Weight shift is moderate in easy stops

REAR BRAKE LOCK-UP

Now, in a hard stop, more braking power is needed so disc brake piston pressure must be quite high to get proper braking action. If this high pressure is also applied to the rear brake system when rear tire traction is reduced by the weight shift, the rear brakes can lock up prematurely.

IT GIVES FLUID A FREE PASS . . .

To reduce rear brake pressure, the proportioning valve has a spring-loaded, sliding core which operates when the hydraulic system reaches a certain pressure. On light pedal applications, the valve simply lets brake fluid pass through as it flows from the master cylinder to the rear brakes. As long as system pressure does not go above 300 pounds, it remains the same at all four wheels.

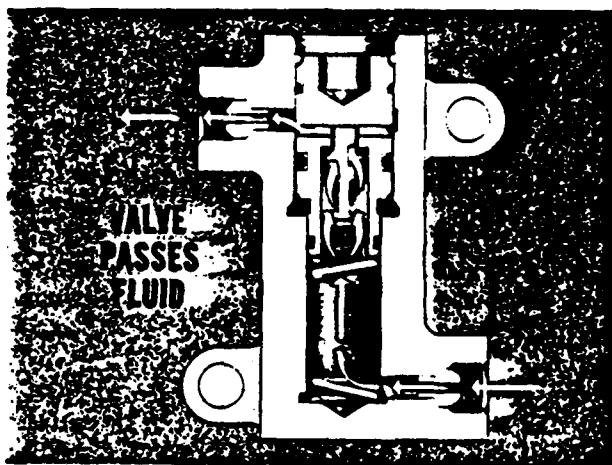


Fig. 14—No proportioning action below 300 pounds

... AND THEN TAPERS OFF

On hard brake applications, system pressure climbs higher and the proportioning valve goes into action. Above 300 pounds, the valve core moves against spring pressure to cut down any further increase in rear system pressure about 50 percent. In effect, the valve provides a pressure difference between the two braking systems to keep front and rear braking forces in balance with the traction change caused by weight shift.

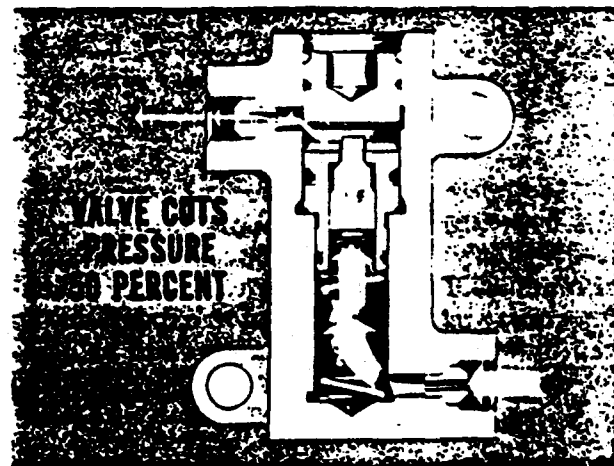


Fig. 15—Pressure above 300 pounds operates valve

For example, when you hit the pedal for a sudden stop in traffic, master cylinder pressure might climb to 700 pounds. The disc brake calipers get the full 700 pounds, but the propor-

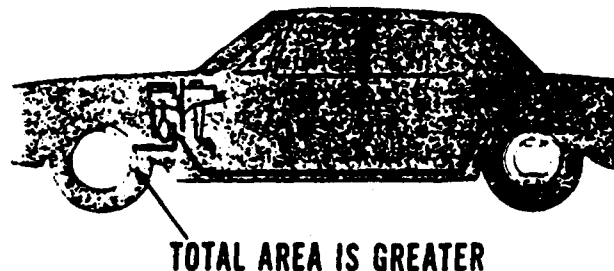


Fig. 16—Larger models are self-proportioning

tioning valve automatically reduces rear brake system pressure to about 500 pounds. Or, if cylinder pressure builds up to 900 pounds in a severe stop, the rear brake pressure will be proportionately lower at about 600 pounds.

LARGER MODELS DO IT DIFFERENTLY

The brake shoe pistons in the Budd brake system do their own proportioning. The total area

of the larger front brake pistons is so much greater than the smaller rear brake area pistons that the same hydraulic pressure can be used front and rear for all kinds of stops.

NOTE: A metering valve will soon be added to the front brake hydraulic system in '67 Imperial models. A service bulletin covering valve operation and service is scheduled for early release.



DISC BRAKE SERVICE AND TROUBLESHOOTING

You'll find detailed procedures for inspecting and servicing the three designs of disc brakes used on Chrysler Corporation cars in your service manuals. Instead of repeating these instructions, this section is intended to expand on the step-by-step service information and to highlight some of the important things you should keep in mind when working on disc brakes.

RELINING IS EASY

Disc brake relining is a simple operation, especially with the Kelsey-Hayes brake where the shoes can be removed and replaced without removing the calipers. You'll have to unbolt Bendix or Budd calipers from the steering knuckle for relining, but the hydraulic hose stays connected so you won't have to bleed the disc brake system.

Follow the relining procedure described in your Service Manuals for each design of disc brake. After every reline job, road-test the car and apply the brakes hard several times to seat the new linings. Until the linings are seated, the car may have a tendency to pull to one side when the brakes are applied.

CAUTION: Be sure you have a firm pedal before you move the car after relining or other brake service work.

PUT 'EM BACK WHERE THEY BELONG

When you remove the brake shoes for any reason other than relining, be sure to put each shoe back in its original location. If you mix up the

shoes, the brakes will feel spongy and can pull to one side until the linings are resealed.

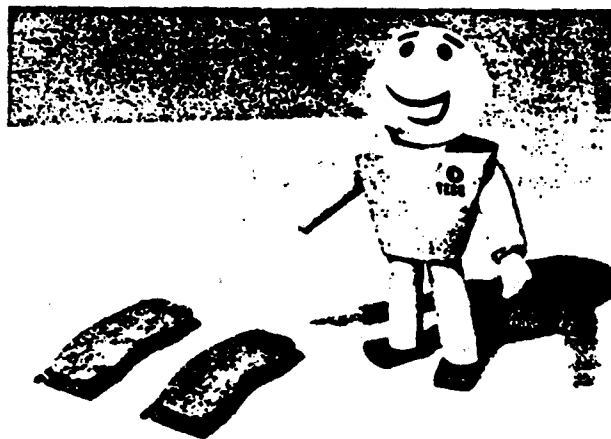


Fig. 17—Misplaced shoes cause uneven braking

IT TAKES TIME

Disc brake linings are harder than drum linings so don't take a chance and expect misplaced linings to reseat after only a few brake applications. Reseating may take quite a while, and your customer will probably object to "wearing them in."

"PUL!" MAY NOT BE IN BRAKES

What seems to be brake pull may not be caused by the brakes at all. If you have a disc brake job that pulls to one side after the brakes check

out okay. take a look at the suspension. Loose steering linkage, poor wheel alignment, or a soft or worn tire can give the same pulling effect as uneven braking.

PISTONS MUST MOVE FREELY

When you replace disc brake linings, be sure to check caliper pistons for free movement. Be especially on the lookout for a jammed or stuck piston if you find a brake shoe with heavy taper wear. Where one piston in a pair is doing all the work, the lining will show heavy wear at that end of the shoe.

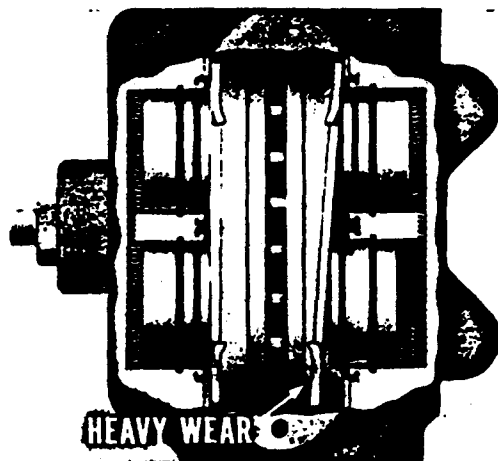


Fig. 18—Jammed piston causes uneven lining wear

SOME TAPER IS NORMAL

But don't jump to conclusions and expect to find piston trouble where linings show only a

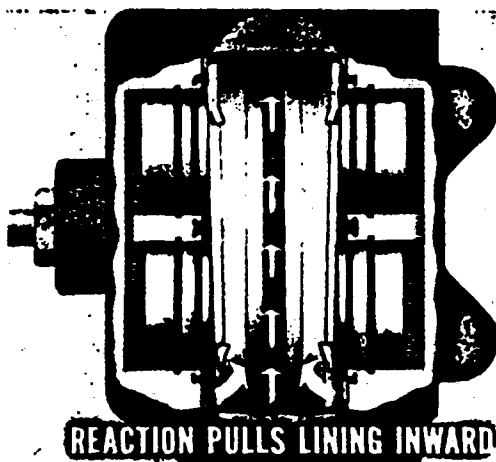


Fig. 19—Slight taper wear is normal

slight amount of taper. Disc linings normally wear a little thinner toward the rear because the friction reaction that occurs when the linings press against the disc tends to move lining ends inward at the rear.

CLEAN 'EM OUT

Before you check piston movement, wipe out the caliper cavity and inspect for fluid leaks. Make sure that the hydraulic hose and the rigid transfer or jumper tube is in good condition.

CAUTION: Do not use high-pressure air to clean the caliper cavity when relining. Air pressure can dislodge the dust boots and may force dirt and grit under the boot edges.

Take a close look at all dust boots to make sure they are firmly seated and free from wear spots, punctures or tears. A dislodged or damaged boot will expose the piston to damage by water and dirt.



Fig. 20—Boot damage admits dirt and water

PUT ON THE SQUEEZE

You can check piston movement easily when the linings are removed from the caliper, and all the pistons are free to move. Use your thumbs to push the pistons in part way, one at a time. Each piston should move smoothly, with no sign of sticking or roughness. But don't cock the pistons or push them in too far or they may jam in the bores.



Fig. 21—Pistons should move smoothly

DISC DIAGNOSIS

As we mentioned before, the disc and wheel hub are serviced as an assembly. And, since a new part is fairly expensive, the assembly should be replaced only if absolutely necessary. In other words, be sure the disc is beyond all hope before you decide to install a new one.

Excessive wear, and rough, grooved disc surfaces are the usual reasons for assembly replacement. However, a disc can have fairly deep grooves and still be usable.

FIRST TRY 'EM OUT . . .

A good rule of thumb to follow in deciding whether a grooved disc is still usable begins with a test drive before you begin a lining replacement job.

If the brakes operate smoothly and do not pull to the side, you can figure that the discs will continue to do a good job after the new linings are installed. When you find that discs are grooved but smooth, in a job where the brakes are otherwise okay, the replacement linings will seat-in with no trouble after a few hard pedal applications during your test drive.

. . . THEN LOOK 'EM OVER

You can also judge disc usability by the condition of the old lining. Where lining is badly torn or gouged, you can expect to find rough grooves on the disc. This roughness will tear up new linings in a hurry, so a new disc is the answer. Don't try to refinish discs . . . too much material must be removed to clean them up.

GROOVES
TEAR UP
LINING

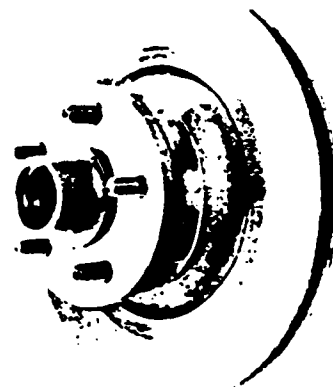


Fig. 22—Rough grooves mean disc replacement

LOOK FOR WOBBLE OR RIPPLE

Where a customer complains that the disc brakes on his car are rough, or that they chatter, the trouble may be caused by excessive disc runout or too much variation in disc thickness. In either case, where the disc condition exceeds limits given in your Service Manual, the disc and hub assembly must be replaced.

RUNOUT INCREASES PEDAL TRAVEL

In the first condition, too much disc runout forces the caliper pistons back into their bores when the brakes are released, producing too much clearance between the disc and linings. When this happens, you'll have to push the pedal down farther to take up the clearance, and there may be some vibration when you apply the brakes.

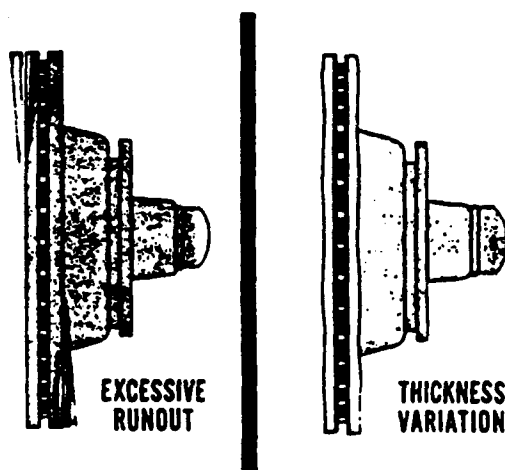


Fig. 23—Disc variations make braking uneven

THICK AND THIN CHATTER

Where disc thickness varies too much, the caliper pistons move in and out as the disc rotates and you'll notice that the pedal pulsates up and down. In effect, the linings grip the disc more tightly at the thick spots around the disc and tend to slip in between. Pedal pulsation can also be caused by out-of-round rear brake drums, so be sure to check the drums before deciding to replace a disc assembly.

DISCS MUST BE COOL AND CLEAR

When you inspect disc brakes, be sure that the air cooling passages in the disc are open so air can flow through. If the passages are plugged with mud, the disc can overheat and cause serious damage.

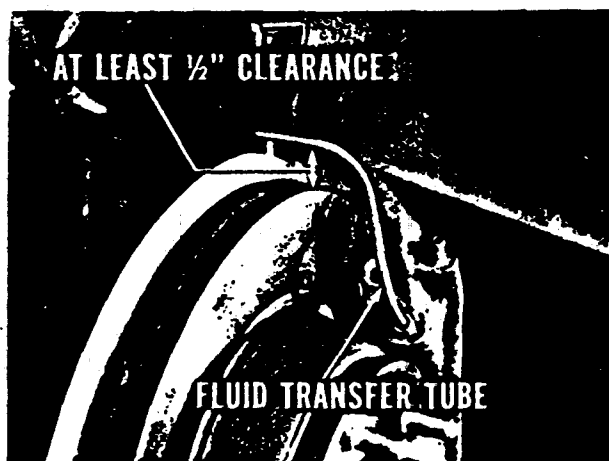


Fig. 24—Transfer tube clears disc

On Valiant, Dart or Barracuda disc brakes, the fluid transfer tube between the caliper piston sets should clear the disc by at least a half-inch. If you position the tube incorrectly so it rubs against the disc, it can wear through.

LINING MATCH-UP

Because different car models have different braking needs, lining material is compounded to produce specific braking reaction for each. And, just as lining size and shape is different in each design of disc brake, the lining material is also different.

This means that replacement linings for disc brakes must have the same friction and fade-resistance characteristics as the originals or the braking action will change.

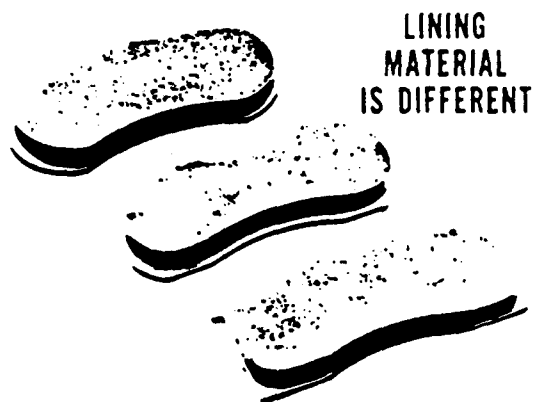


Fig. 25—Replacement lining must match originals

DRUM BRAKES ALSO MATCH

Rear drum brakes fall into the same category because the original linings are designed to work in balance with the disc brake linings in the front. So, to keep the braking balance unchanged in front and rear, it's best to use only the correct linings for replacement.

PROPORTIONING VALVE PROBLEMS

As you already know, the proportioning valve used on our compact and intermediate-size models reduces pressure to the rear brakes about 50 percent when hydraulic pressure in the brake system goes above 300 pounds.

FROM LOCK-UP . . .

Where the proportioning valve sticks open and does not properly reduce system pressure, it's the same as having no valve at all. The usual sign of sticky valve trouble is a tendency of the rear wheels to lock up prematurely.

. . . TO NO BRAKES AT ALL

At the other extreme, a dirt-clogged valve can block off flow to the rear wheels so there will be little or no rear braking action. If this happens, the full braking load will be on the front brakes. You'll have to use considerably more than normal pedal pressure to stop the car, possibly to the point where the front brakes lock up.

CHECK THE PROPORTION

Where you suspect that a proportioning valve is not working properly, check it out using the procedure described in your Service Manuals.

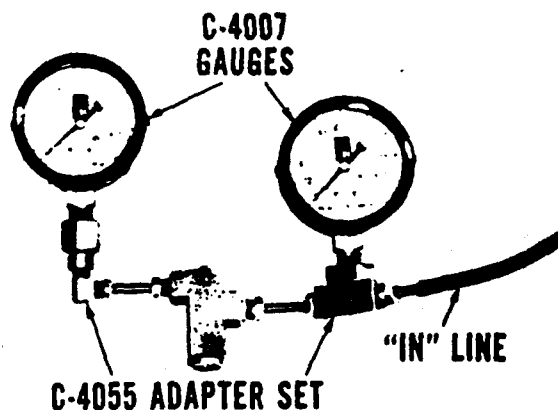


Fig. 26—Proportioning valve test (compacts)

The valve testing job will be easier if you use the new C-4055 Adapter Set to connect your C-4007 Gauges. These adapter fittings take the place of the gauge hoses used in testing 1966 model proportioning valves. They connect the gauges directly at the valve, so there's no problem with trapped air. You can connect the gauges more easily if you unbolt the valve from the frame.

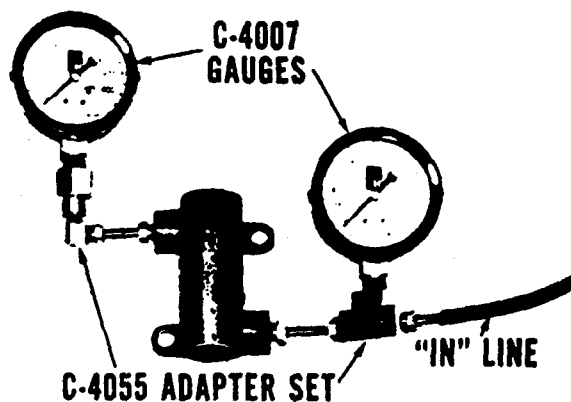


Fig. 27—Proportioning valve test (intermediates)

BRAKE BLEEDING HINTS

Prior to replacing disc brake linings, most of the fluid should be removed from the master cylinder rear reservoir to prevent back-up overflow when you compress the caliper pistons.

The reservoir has enough capacity to keep the

fluid from dropping below a safe level before the linings are worn to the point where they should be replaced. However, since the linings are quite thick, a large volume of fluid is drawn from the rear reservoir as the pistons move to compensate for lining wear.

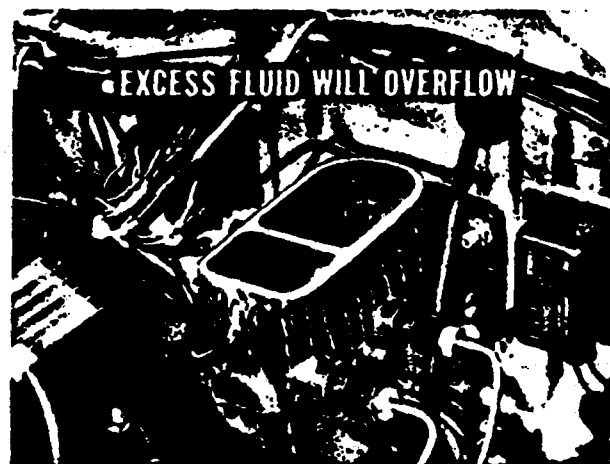


Fig. 28—Relining moves fluid back to reservoir

When the brakes are ready for lining replacement, only a half-inch of fluid may remain in the reservoir. But, if some technician has refilled the reservoir before the brakes are relined, there will be too much fluid in the system. This excess will overflow from the reservoir if it's not removed before the new lining is installed. Fluid level in the master cylinder front reservoir will also drop as rear brake lining wears, but not so much as the rear.

KEEP IT CLEAN

Any time you remove the master cylinder cover be careful to keep dirt and moisture out of the reservoirs. Dirt is bad enough, but brake fluid has a high affinity for moisture. In other words, brake fluid will "soak up" water like a sponge and hold it in the system where it can cause rust damage in master cylinder and caliper bores. If water gets into the brake fluid, it may cause boiling in severe brake applications.

DISC BRAKE BLEEDING, '67 STYLE

Bleeding disc brakes on the '67s is a little different from previous models because it's more difficult to get air bubbles out of the dual brake system. The procedure is simple but requires

more care to make sure that no trapped air is left in the system.

FILL BEFORE BLEEDING

First, remove the master cylinder cover and gasket, being careful to keep them clean so dirt will not be carried into the reservoir when they are replaced. Make sure the reservoirs are filled and kept full while bleeding the brakes so no air will be drawn into the system.

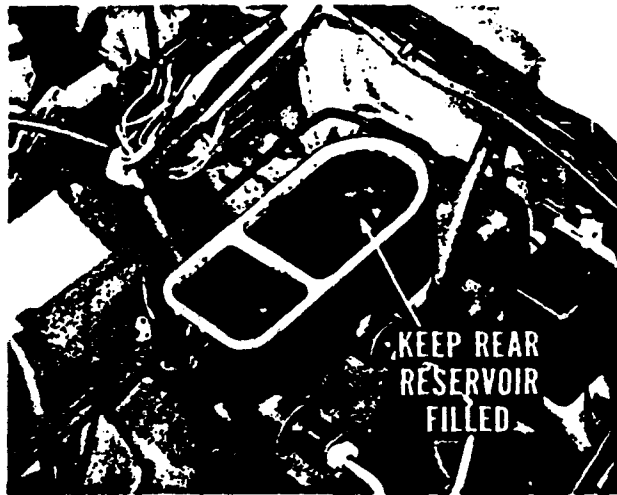


Fig. 29—Full reservoirs keep air out

Because you may have to bleed out a considerable amount of fluid, you can save yourself a mess by leading a bleed hose into a clean glass bottle or jar containing a small amount of fluid.

LET 'ER RUN

When everything is ready, open the bleed screw at least one full turn and let the fluid drain without applying pressure at the pedal. The fluid will drain without pressure because there's no residual pressure valve in the rear outlet port of the master cylinder used with disc brakes. Be sure the bleed screw is fully opened so small air bubbles will not be trapped in the caliper or pressure line.

Don't expect a gush of fluid when you open the bleed screw because normal bleed flow is slow without pressure in the system. Just be patient and keep the bleed hose end under the fluid surface so you can watch for air bubbles. Keep the fluid draining until bubbles stop appearing and then close the bleed screw tightly.

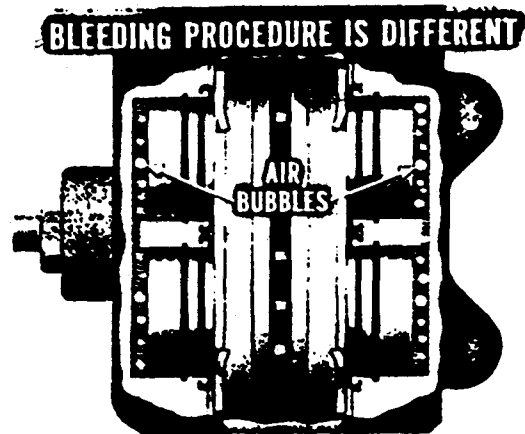


Fig. 30—Free flow removes air bubbles

AIR BUBBLES CAN HIDE

Make sure you get rid of all the air and don't be fooled by pedal feel. If there's trapped air in the system, the pedal may feel firm but later may go nearly to the floor the first time it's used after the car has stood for a while. Where this happens, you'll have to bleed the brake system again.

REAR BRAKES SPURT, BUT

You can use pedal pressure in the usual manner to bleed the rear drum brakes. But, don't worry if there's only a short spurt of fluid when you open the bleed screw. It can't put out a long spurt like previous cylinders because only the front piston displacement is available to the rear brakes.

THE CYLINDER MUST COMPENSATE

It's good practice to check the master cylinder compensating ports after you service a master cylinder or replace a power brake unit. If the ports are not open, the brakes may drag and wear out the linings in a hurry.

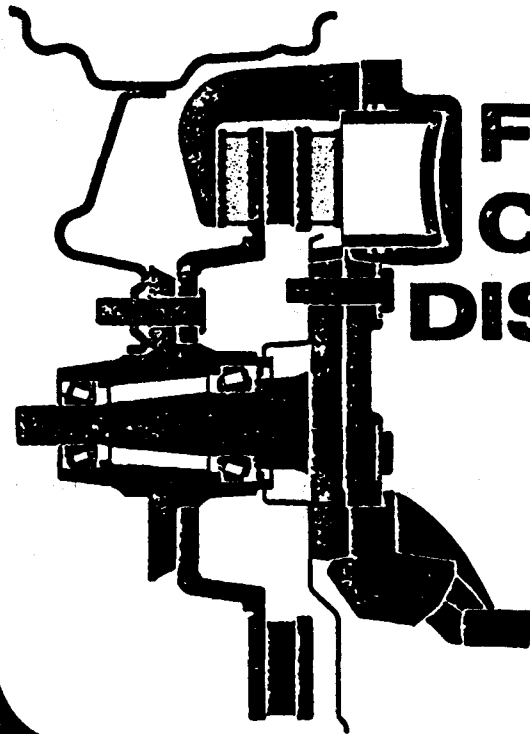
To check the ports, get someone to pump the pedal quickly a few times to trap pressure in the brake system, and then release it slowly. Master cylinder compensation is okay if the fluid spurts or swirls in the reservoirs as the pedal is slowly released.

MASTER CYLINDER DIMENSIONS	Master Cylinder	
	Bore	Stroke (in.)
Disc Brake		
Kelsey-Hayes	1	1
Bendix	1 1/8	1
Budd	1 1/8	1 1/8

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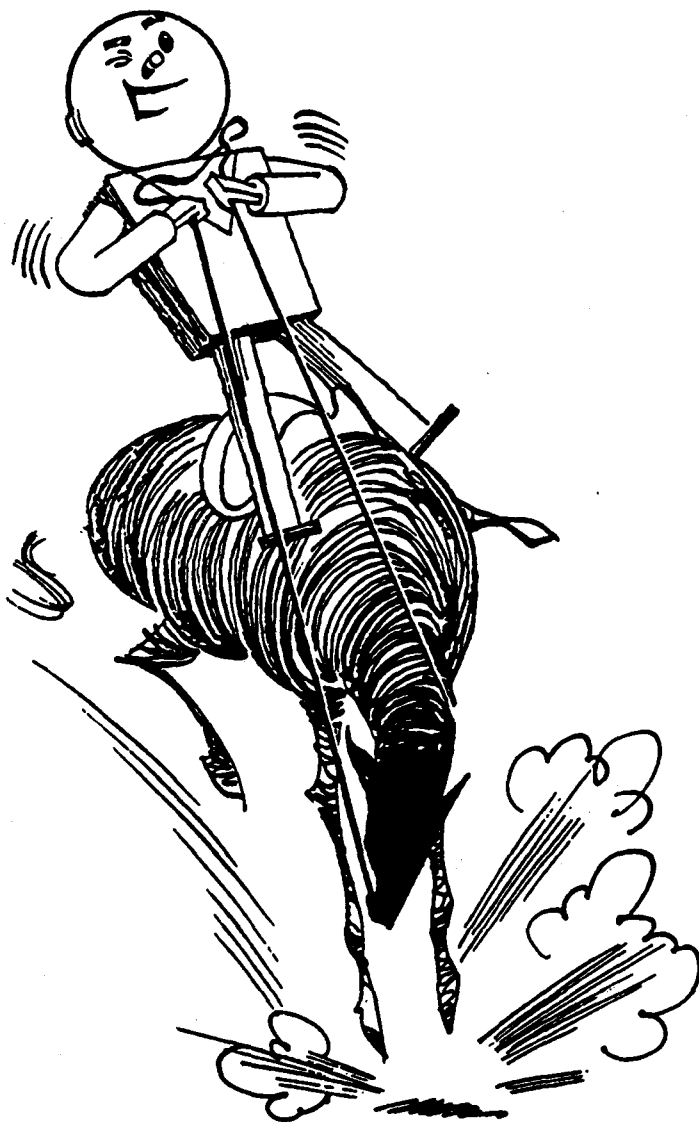


**FLOATING
CALIPER
DISC BRAKES**

**PLYMOUTH
DODGE
CHRYSLER
IMPERIAL
DODGE TRUCKS**



CHRYSLER
MOTORS CORPORATION



A WORD ABOUT BRAKE POWER

Few people realize that today's automobiles have far more "WHOA POWER" than "GO POWER". We hear a lot about horsepower but not too much about brake-power. For example, a three-hundred-horsepower engine isn't unusual these days. That's a lot of power but it has to take a back seat to the brake-power built into that same automobile.

For purposes of illustration, it's reasonable to assume that a car with a three-hundred-horsepower engine will accelerate from 0 to 60 miles an hour in about 10 seconds. That means it will also take about three-hundred horsepower to bring that same car to a complete stop from 60 miles an hour in 10 seconds. But stopping in 10 seconds isn't fast enough! Under some conditions we may want to stop in 5 seconds . . . or less. In other words, the brake-power requirement is at least twice the car's horsepower or 600, plus. That's a lot of brake-power!

Our drum-type brakes provide all of the brake-power required to stop the car safely under all normal driving conditions. However, disc brakes have operating characteristics that make them attractive to many drivers. This book will introduce you to the newest addition to our family of fine brakes . . . the floating caliper disc brake.

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THE FLOATING CALIPER BRAKE DESIGN

The new single-piston, floating caliper, disc brake is quite different from the four-piston, fixed caliper brakes you have worked on in the past. For instance, how one large piston manages to do the work of the four smaller pistons used on other disc brakes deserves an explanation.

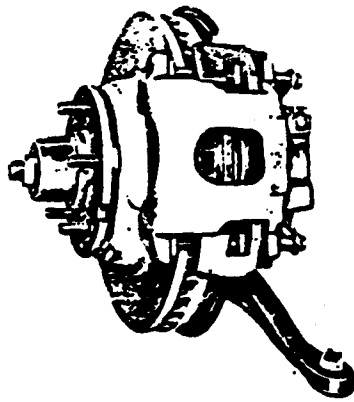


Fig. 1—Floating caliper disc brake

ACTION AND REACTION

In the four-piston disc brakes you are familiar with, the caliper is fixed. To produce equal

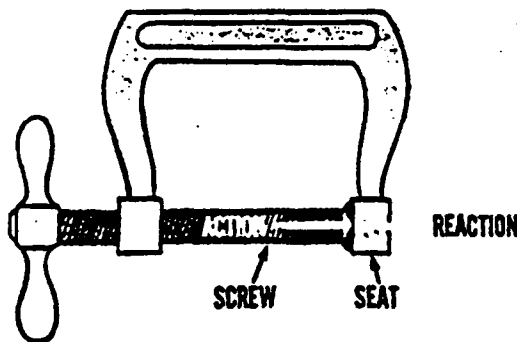


Fig. 2—C-clamp illustrates "action" and "reaction"

braking force against both sides of the brake disc, two pistons push each of the two shoes against the opposite sides of the disc. The new single-piston brake utilizes the basic principle that "for every action there is an equal and opposite reaction" to produce equal braking force on both sides of the disc.

Let's use an ordinary "C" clamp to illustrate the principle involved in the floating caliper disc brake. When you tighten the screw of the clamp, the screw pushes against the seat . . . that is the "action" part of the principle. But, the seat pushes back or resists the push of the screw an equal and opposite amount so you don't need a screw in each end of a C-clamp.

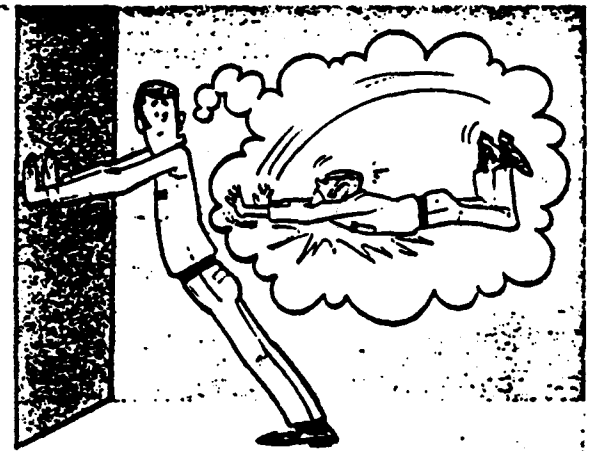


Fig. 3—The wall really does "push back"!

If you find it a bit difficult to visualize how something that doesn't move can exert a push, try putting your hands out in front of yourself and lean your weight against a wall. Now imagine what would happen if someone suddenly took the wall away so that it wasn't pushing back against your hands . . . an equal and opposite amount! Get the picture?

So—we can say that two of the small pistons, used in other disc brakes, do the acting and the other two simply provide the reacting force. In other words, the one large piston used with the floating caliper only has to do the work of the pistons on one side of the disc in a fixed caliper brake.

BUT ONE DOESN'T EQUAL TWO

Sooner or later you'll notice that the one big piston used with the new brake isn't equal in

BRAKING DEPENDS ON FRICTION & FORCE

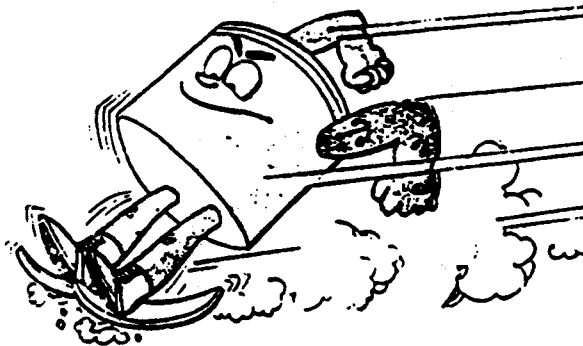


Fig. 4—Linings have a higher coefficient of friction

effective area to two of the smaller pistons used in our other disc brakes. So we better explain "how come" before you get a chance to ask.

The amount of braking done depends on lining friction as well as the force pushing the lining against the disc. The coefficient of friction of the lining used with the single-piston brakes is about fifty percent higher than it is for the lining used with our other disc brakes. This more than offsets the difference in piston area.

THE ADAPTER SUPPORTS THE CALIPER

When you look at a completely assembled brake it is a bit difficult to figure out what moves... what stands still... and exactly how the floating caliper brake works. So, let's take a brake apart and get acquainted with the major working parts.

ADAPTER IS THE FIXED SUPPORT

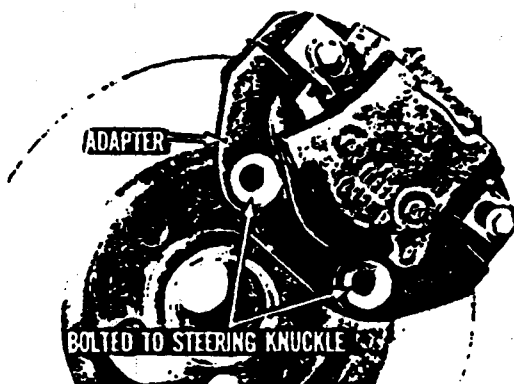


Fig. 5—The adapter supports the floating caliper

The adapter is the backbone or support for the floating caliper. It's bolted directly to the steering knuckle so it takes all of the braking loads. Functionally, it does the same thing for a disc brake that the support plate does for a drum-type brake. The adapter is a stationary member and the disc is the rotating member. Notice that the disc is much thicker than the ones used with our other disc brakes. A positive method of retaining the shoes makes it safe to machine the discs. But more about that later.

THE SINGLE-PISTON CALIPER

The caliper is a one-piece casting having a single cylinder bore on the inboard side of the brake. A square-cut rubber piston seal fits into a machined groove in the cylinder bore.

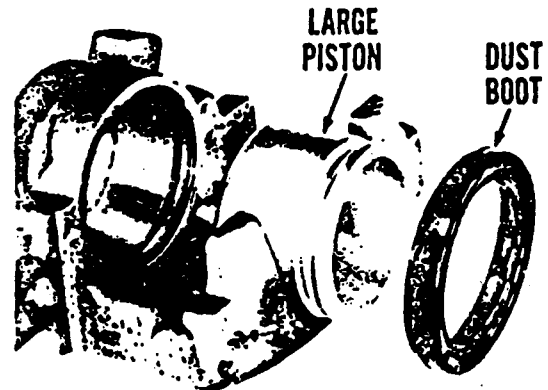


Fig. 6—The piston is nickel and chrome plated

The large, single, piston is nickel and chrome plated to provide very good resistance to wear and corrosion. A rubber dust boot provides corrosion protection to the piston and the cylinder bore. To better understand the functional features of the piston, seal, and boot, let's take a look at a sectional view of the cylinder and piston.

THE SEAL WORKS LIKE A RETURN SPRING

When hydraulic pressure is applied to the piston, it moves outward. Since the seal is a pressure-tight fit against the piston, it tends to move with the piston. In other words, it bends outward with the piston.

When the brakes are released, the spring action of the distorted seal pulls the piston back into its bore. This relieves the pressure on the brake

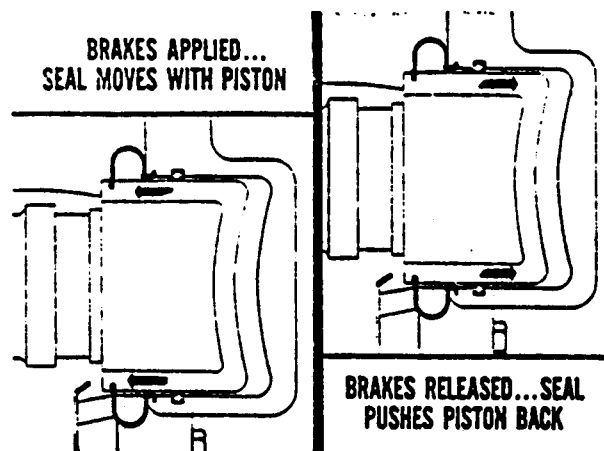


Fig. 7—The piston seal bends and moves with the piston

shoes and establishes running clearance between the shoes and the disc.

THE DUST BOOT DOES DOUBLE DUTY

The dust boot forms an airtight seal at both the piston and the cylinder. A lip rides on the piston and this keeps the boot seated in its groove inside the cylinder. The other lip of the boot fits tightly into a groove machined in the piston.

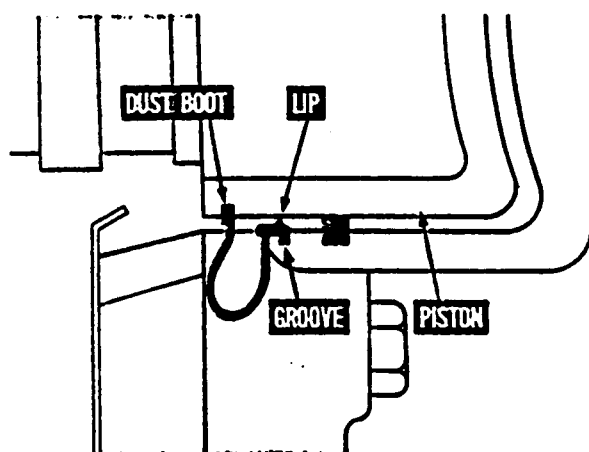


Fig. 8—The dust boot forms an airtight seal

It is extremely important to make sure the dust boots are in good condition and sealing effectively. Moisture is as much an enemy of the hydraulic brake system as dust and dirt.

That's because the excellent, high-boiling-point brake fluid required for a modern brake system has a tremendous thirst for water. Exposing this fluid to moisture-laden air will

result in serious contamination of the fluid and eventual corrosion of metallic parts. That's why you must never leave a brake fluid container open and exposed to the moisture-laden air.

A PAIR OF SHOES FOR THE CALIPER

The two brake shoes fit into the caliper. The inboard shoe rests against the piston. The outboard shoe simply bottoms against the machined surface in the outboard side of the caliper. It's easier to see the relationship of the shoes to the caliper before the brake is completely assembled.

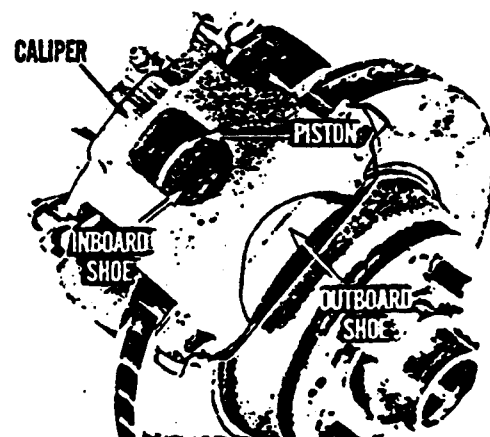


Fig. 9—The inboard shoe rests against the piston

THE GUIDE PINS DON'T MOVE

It is also difficult to visualize the relationship between the guide pins, the caliper and the adapter when the brake is assembled.

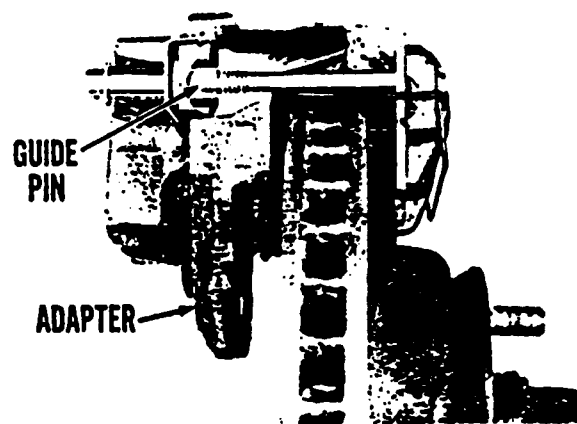


Fig. 10—The guide pins are threaded into the adapter

The accompanying illustration shows how the two steel guide pins are threaded into the adapter. That means they are fixed or non-moving parts. They help guide and position the floating caliper as it moves from side to side. The guide pins also pass through holes at either end of the two brake shoes. This provides positive retention of the shoes in the caliper.

POSITIONERS COMPENSATE FOR LINING WEAR

The guide pins slide through four rubber bushings in the caliper as well as the four retaining holes in the two brake shoes. The positioners at the inboard end of the guide pins hold the caliper outward, away from the disc, when the brakes are released. The positioners are not ordinary springs. They are adjustable spacers which actually bend and close up as the linings wear. They automatically compensate for lining wear. Since the positioners are compressed and gradually close up as the linings wear, they must be replaced when new shoes are installed or whenever the caliper is serviced. New rubber bushings for the guide pins must also be installed when the brakes are relined.

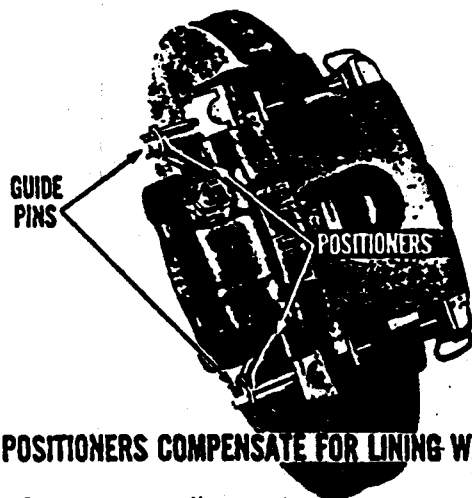


Fig. 11—The positioners actually bend as the lining wears

CALIPER ALIGNMENT AND BRAKING LOADS

The caliper is a precision, sliding fit in the adapter. At four points, mating, machined surfaces on both the caliper and the adapter maintain caliper alignment. These machined surfaces take all of the braking loads. There are no braking loads on the guide pins or the rubber bushings in the caliper.

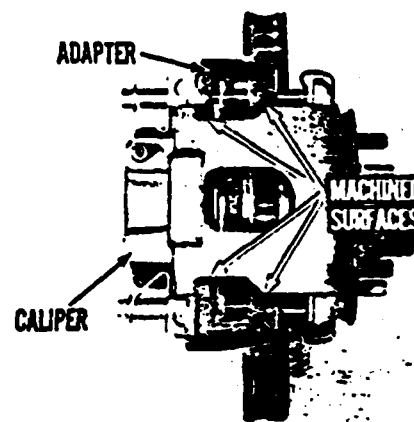


Fig. 12—Machined surfaces take the braking loads

DISC BRAKE LININGS ARE HARD AND TOUGH

The brake disc is clamped between the two shoes when the brakes are applied, the apply force is always equal on both sides and there is no disc distortion . . . even at high temperatures. Much higher brake application force is used with disc brakes but less lining area is required than with drum brakes to provide equal or greater braking effort.

LINING MATERIAL HARDER...



...MORE RESISTANCE TO FADE

Fig. 13—Disc brake linings tolerate higher temperatures

Very hard lining material is used with disc brakes in order to withstand the high compression force needed to produce good braking. These hard linings can stand much higher temperatures and are more resistant to brake fade.

AND THEY'RE THICKER, TOO

In addition to being harder, disc brake lining is much thicker to provide good lining life. As

these thicker linings wear, the large disc brake pistons move outward quite a way as they automatically compensate for lining wear. That's why more fluid capacity is needed in the reservoir of the master cylinder used with disc brakes. As a matter of fact, the master cylinder used with floating caliper disc brakes is not the same as the one used with other disc brakes. So let's take a look at the master cylinder and the rest of the hydraulic system used with these new disc brakes.

THE MASTER CYLINDER AND HYDRAULIC SYSTEM

The master cylinder used with the new floating caliper disc brakes is not exactly like or interchangeable with any of our other master cylinders. But let's review exactly how a dual hydraulic brake system works so you'll understand the differences.

ONE BORE AND TWO PISTONS

All of our tandem master cylinders have two separate brake fluid reservoirs. However, they have a single cylinder bore and two separate pistons which operate in tandem. Of course, all disc brake master cylinders have deeper reservoirs and more fluid capacity.

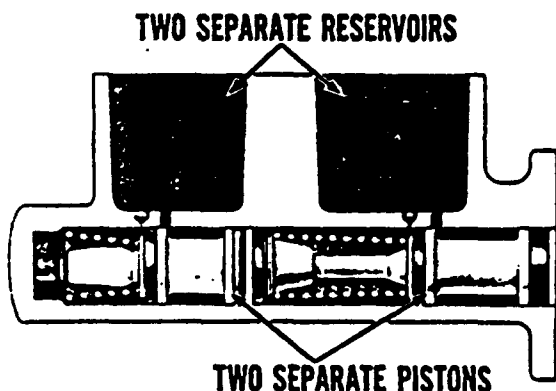


Fig. 14—Disc brake master cylinder

It's a lot easier to keep things straight if we call the rearward piston the *primary* piston because it is actuated directly by the brake pedal push rod. Besides, the primary piston supplies pressure to the front brakes where most of the braking is done on all but very light brake applications.

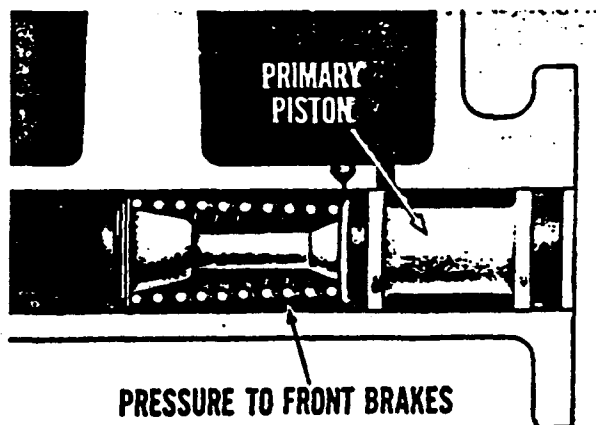


Fig. 15—The brake pedal actuates the primary piston

The piston at the forward end of the master cylinder is the secondary piston and it supplies pressure to the rear brakes. In normal operation, hydraulic pressure from the primary piston operates the secondary piston. In other words, there is a hydraulic link between the two separate sections of the dual hydraulic system and the same pressure is supplied to the front and rear brakes by the master cylinder in normal operation.

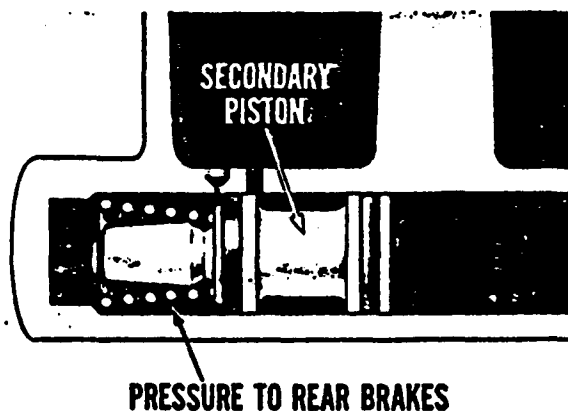


Fig. 16—Hydraulic pressure actuates the secondary piston

WHEN THE BRAKES ARE APPLIED

Here is what happens when the brakes are applied. The somewhat stiffer primary piston spring pushes the secondary piston forward, compressing the weaker secondary spring slightly. The secondary compensating port is closed off and pressure starts to build up in the forward chamber. At the same time, the primary compensating port has also been closed off. The correct amount of fluid is now trapped in front of each piston and pressure is developed in the primary and secondary chambers.

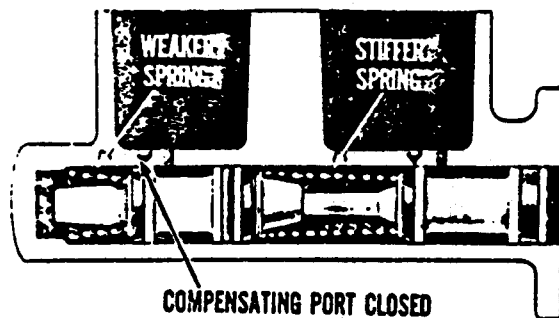


Fig. 17—Equal pressure in secondary and primary systems

THE MASTER CYLINDER IS SPECIAL

The master cylinder for the single-piston disc brake system has a longer stroke and greater capacity than most of our other master cylinders. What's more, the division of fluid capacity between the primary and the secondary

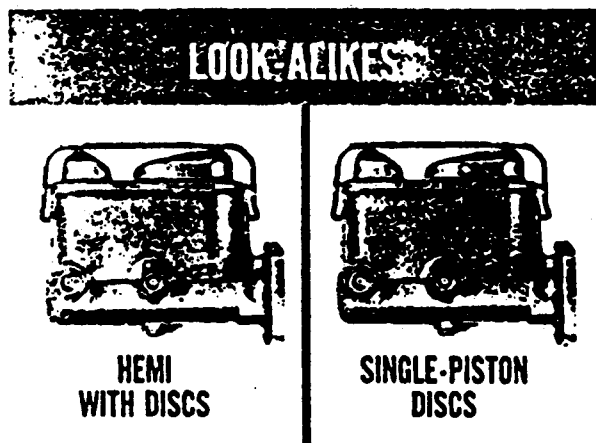


Fig. 18—These master cylinders must not be interchanged

systems provides more reserve capacity for the front disc brakes than is needed for other brake systems.

The master cylinder for a Coronet, Charger, Belvedere or Satellite, equipped with a Hemi-engine and disc brakes, looks exactly like the master cylinder used with floating caliper disc brakes. These master cylinders must not be interchanged. As a matter of fact, neither the pistons nor the master cylinder assemblies should be interchanged, so don't mix up the complete assemblies or the separate parts.

NO RESIDUAL VALVE FOR THE DISCS, PLEASE

All master cylinders for drum-type brakes have residual valves in both the primary and the secondary outlets. These valves maintain a small amount of hydraulic pressure in the wheel cylinders. The residual pressure keeps the piston cup lips expanded so they press against the cylinder wall to form a good seal. This keeps air from being sucked past the wheel cylinder cups when the brakes are released.

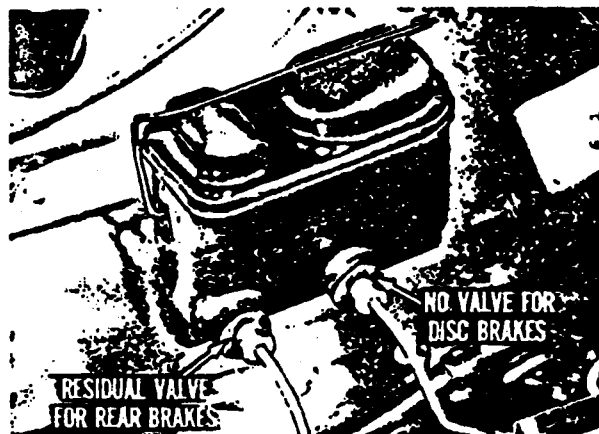


Fig. 19—No residual valve in the primary system

On cars equipped with disc brakes, the master cylinder must have a residual valve in the forward or secondary outlet of the master cylinder to maintain pressure in the rear wheel cylinders. This pressure is never great enough to prevent the brake shoe return springs from retracting the shoes so there is no brake drag.

A residual valve must not be installed in the primary outlet at the rearward end of the master cylinder. Residual pressure in the primary brake lines would make the disc brake shoes drag and wear out prematurely. That's

because the pistons are large and there are no shoe return springs with disc brakes.

DUAL-PURPOSE BRAKE WARNING LIGHT

Next in the brake hydraulic system is the brake warning light. In addition to warning the driver if pressure is lost in either the primary or secondary system, it reminds him to release the parking brake before he drives away. Let's review the way the warning light switch works.

The primary brake line from the master cylinder is connected to one end of the switch and a line supplying the front disc brake is connected at this same end. With the single-piston disc brakes, one outlet at this end of the switch is plugged . . . you'll see why a couple of paragraphs from now.

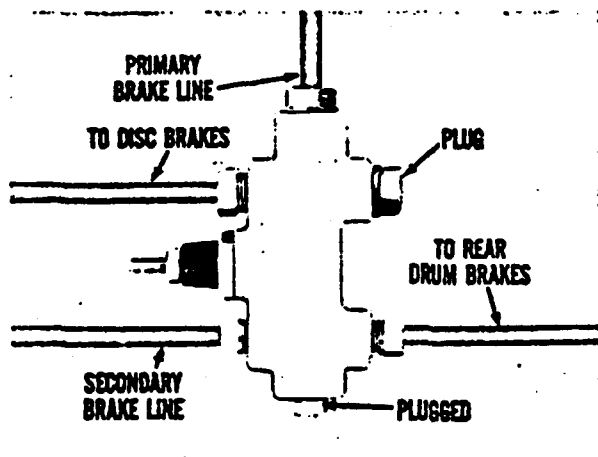


Fig. 20—Brake warning light switch connections

The line from the secondary outlet of the master cylinder is connected at the other end of the switch and a fourth line leads to the rear drum brakes. At this end of the switch, the end outlet is plugged on all applications.

INSIDE THE BRAKE WARNING LIGHT SWITCH

Inside the switch, a barbell-shaped double-headed piston, with an "O" ring seal at each end, separates the front brake hydraulic system from the rear brake system. Coil springs at either end of the piston keep the piston centered as long as the pressure is the same in both parts of the hydraulic system.

If pressure is lost in one system, for example the front brakes, pressure in the rear brake system pushes the piston off-center. As soon as

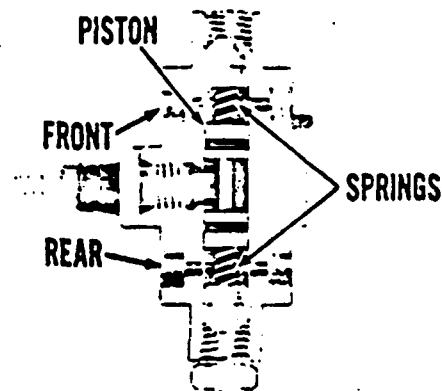


Fig. 21—Springs keep the piston centered

the piston moves far enough to touch the ground contact of the warning light switch, the warning light ground circuit is completed and the light comes on.

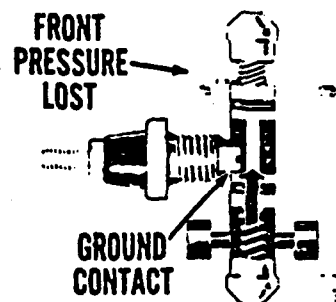


Fig. 22—Pressure moves the piston off center

The springs in the switch are quite stiff so that minor variations in pressure won't turn the warning light on. For example, residual pressure in the secondary system will not cause the light to come on even when the primary system pressure is released.

THE DISC BRAKE METERING VALVE

Although drum brakes and disc brakes have different characteristics, the floating caliper disc brakes are designed for excellent balance with the new rear drum brakes. However, on icy or extremely slippery road surfaces, it is desirable to reduce front-wheel braking. That's

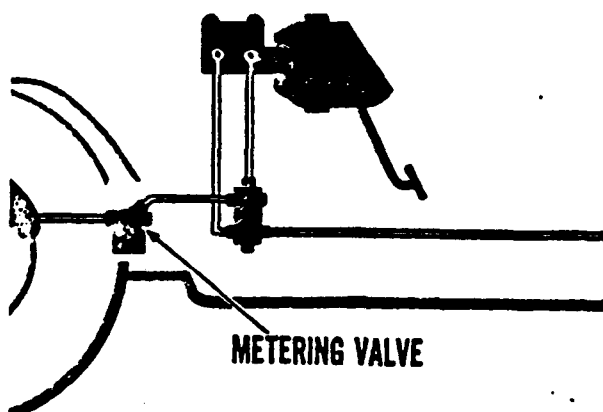


Fig. 23—Metering valve holds off pressure to disc brakes

where the metering valve comes in. It cuts off pressure to the front brakes in the range from about 10 psi to about 115 psi.

This should not be confused with the proportioning valve used with some of our other disc brakes. The proportioning valve *reduces* pressure to the *rear* brakes to prevent rear-wheel skid on *hard* brake applications. The metering valve *holds off* pressure to the *front* brakes under very *light braking* conditions to prevent front-wheel skid on icy or wet surfaces. As a matter of fact, the metering valve is sometimes called a hold-off valve.

ONE "IN" AND TWO "OUT"

The metering valve fits into the hydraulic system between the warning light switch and the front disc brakes. There is only one brake line from the warning light switch to the metering

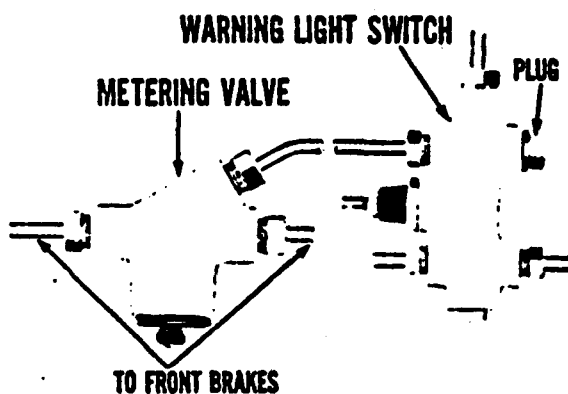


Fig. 24—Metering valve connections

valve. That's why one of the primary lines from the warning light switch is plugged on this installation. There are two lines leading from the metering valve . . . one line for each front brake caliper.

INSIDE THE METERING VALVE

The metering valve is serviced as an assembly so you won't have to be concerned with repairing it. However, if you know what's inside the valve you'll have a better understanding of some of the service precautions that apply. In the accompanying illustration, note that there is a check valve and a valve seat. The valve seat is mounted in a moveable valve plate. A spring holds the valve plate closed. The check valve at the upper end of the push rod is normally open to insure complete release of pressure to the disc brakes. As soon as the brakes are applied, pressure acts on the diaphragm at the lower end of the push rod.

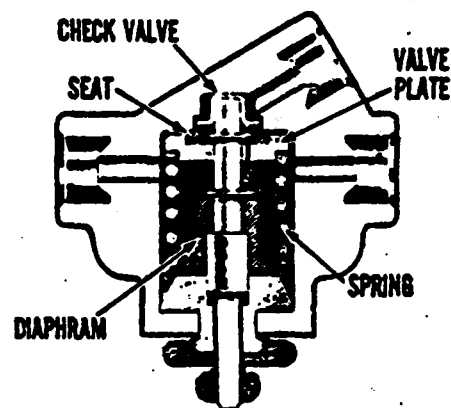


Fig. 25—Metering valve construction details

It only takes about 10 psi to move the diaphragm far enough to seat the check valve. This cuts off all pressure to the front brakes. As a result, the rear brakes do the braking when very light pedal pressure is applied. This insures good braking and steering control under slippery operating conditions because it reduces the likelihood of front-wheel skid.

When master cylinder pressure gets up to about 115 psi, the push on the check valve and valve plate overcomes the valve spring pressure and unseats the valve plate. From about 115 psi to 500 psi, the pressure difference between the primary and the secondary is gradu-

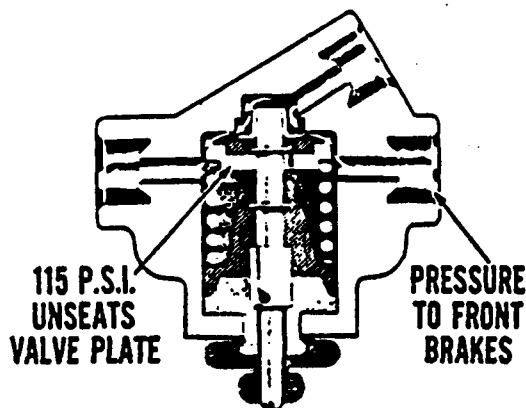


Fig. 26—Pressure opens the metering valve plate

ally reduced until, at about 500 psi, pressure to the front and rear brakes is the same.

REAR BRAKES AND PARKING BRAKES

All full-size 1969 models have new 11-inch, drum-type brakes front and rear. The front drums have deep ribs cast into the outer surface of the drum. The rear drums have shallow ribs and a wide flare cast into the surface of the drum. These ribs and flares increase the amount of surface exposed to the cooling air,

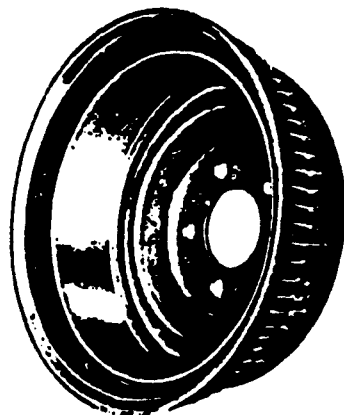


Fig. 27—Ribbed and flared rear brake drum

increasing the rate of heat dissipation. These new drums are used with new 15-inch ring-mounted wheels. Larger wheels promote better cooling and the ring mount feature minimizes drum distortion.

In other words, the standard production brakes on the full-size models will be bigger and better for 1969. But this is a disc brake story so we are primarily interested in the features of rear drum-type brakes and parking brakes used with floating caliper disc brakes.

PARKING BRAKE CABLE ASSEMBLY

New parking brake cable assemblies are used on all full-sized models. The new assemblies have stiffer return springs and both the type of cable lubricant used and the method of lubricating the cable have been improved. The new cable insures parking brake release and reduces the possibility of rear brake drag. The new parking brake cable assemblies can be used on previous models. However, if you replace one rear cable with one of the new cable assemblies you must also replace the other rear cable assembly. One new and one previous model assembly must not be used. The new cable assemblies can be identified by a *zinc-colored* spring on the left assembly and a *blue-colored* spring on the right assembly.

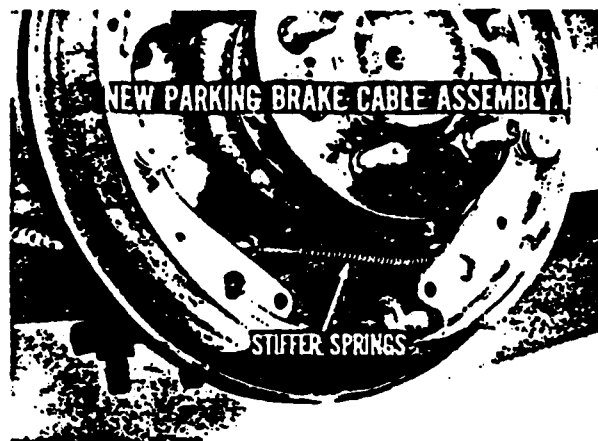


Fig. 28—New cable assembly insures parking brake release

DRUMS ARE BETTER AT THE REAR

People often ask why disc brakes aren't used both front and rear. The answer is a combination of economics and need. Disc brakes at the rear would seriously complicate the parking brake design. It would take a complicated and

bulky leverage system to provide enough apply force to insure adequate parking brakes if discs were used at the rear.

On the other hand, drum-type brakes provide a simple and effective mechanical parking brake system. Besides, under the severe braking conditions which make disc brakes desirable up front, little or nothing would be gained by installing disc brakes at the rear. Our new rear drum brakes provide just about all the wheel-stopping force the rear tire-to-road friction can utilize on hard braking from higher speeds. That's because the weight shift reduces braking traction in the rear and increases it up front. It makes economic sense to put the discs where the traction is!

SERVICE SUGGESTIONS AND PRECAUTIONS

This is a good place to remind you that your Service Manuals contain complete information on servicing floating caliper disc brakes. You'll also find sections covering the master cylinder and complete hydraulic system and the new rear-wheel brakes used with this disc-brake system. It's also a good idea, when servicing these brakes or any other part of the car for that matter, to check your Service Bulletin file for possible changes in service instructions.

It would serve no useful purpose to reproduce the Service Manual here. However, the following suggestions and precautions may help you avoid costly mistakes and possible comebacks.

YOU CAN MACHINE THESE DISCS

The positive shoe retention provided by the guide pins makes it safe to resurface the discs used with the floating-caliper brake. However, if you resurface one face you must resurface the other face without rechucking the disc. That's because the maximum allowable variation in thickness must not exceed .0005 of an inch. It is virtually impossible to rechuck a disc and hold this tolerance. It is very easy to hold this tolerance if you use good equipment that permits refinishing both faces without rechucking the disc.

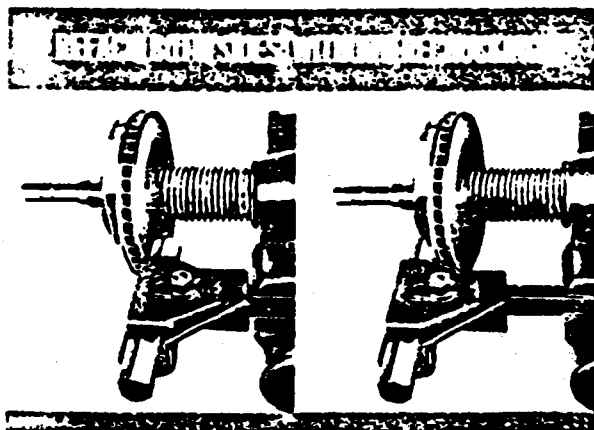


Fig. 29—Maximum allowable variation in thickness is .0005"

NOT MORE THAN .050 OF AN INCH, PLEASE

When you resurface a disc, you must not remove more than a total of .050". For example, this could be .040" from one side and a maximum of .010" from the other . . . or any other combination that does not exceed a total of .050". In addition, you must not reduce disc thickness to less than 1.20". So, take it easy and don't remove any more material than necessary to clean up both faces.

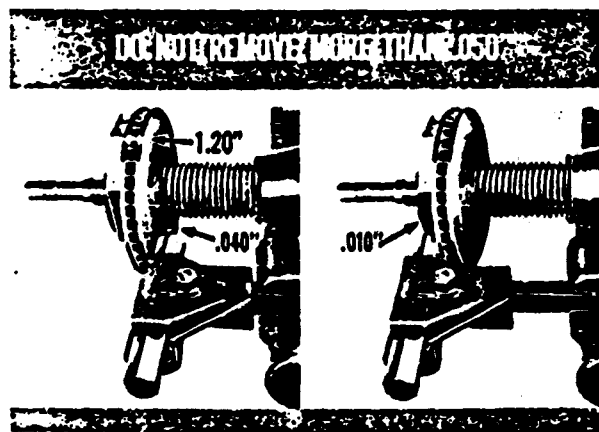


Fig. 30—Disc thickness must not be less than 1.200"

WHY THICKNESS VARIATION IS CRITICAL

You'll notice in the Service Manual that thickness must be measured at twelve points around the circumference of the disc at a distance of one-inch from the edge. This is the method used to determine maximum variation in thickness. If thickness varies more than .0005", the piston will be pushed in and out as the disc rotates. This will cause objectionable brake pulsation.

RUNOUT IS LESS CRITICAL

Since the caliper is free to float from side-to-side, a small amount of runout will not affect braking adversely. The maximum allowable runout, measured one inch from the edge of the disc, must not exceed .0025".

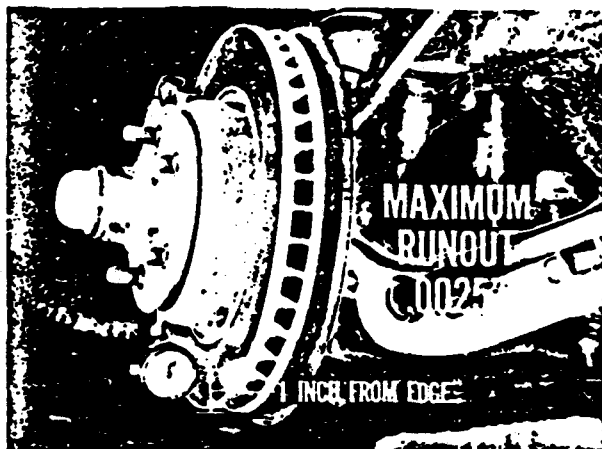


Fig. 31—Measuring disc runout

USE THE SPECIAL PISTON PULLER

A special piston-removing tool (C-4087) is available for pulling the piston out of its bore. This tool makes it much easier to remove the piston without damaging the sealing surface. Under no circumstances should air pressure be used to blow the piston out of its bore. This practice is dangerous and may result in serious personal injury.

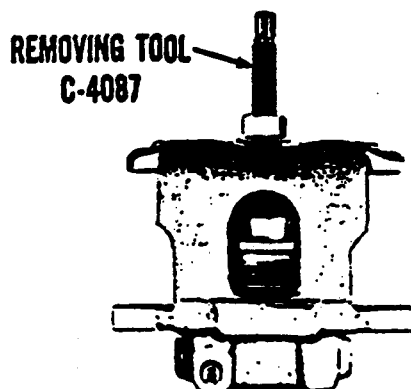


Fig. 32—Use special tool to remove piston from bore

Use a small, pointed wood or plastic stick to pry the piston seal out of its groove in the piston

bore. Do not use a screwdriver or other metal tool to "dig" the seal out because you may scratch the bore or burr the seal groove.

CLEAN UP THE PISTON BORE AND GROOVES

A special large hone is available for cleaning up the cylinder bore and the land between the piston and the seal grooves. And, it is extremely important to clean out both the seal groove and the dust boot retaining groove. You can use a bronze wire brush dipped in brake fluid to clean these grooves. Whatever you do, don't scrape any metal from these grooves. Be sure and flush out all traces of dirt and grit after honing the cylinder and cleaning the grooves.

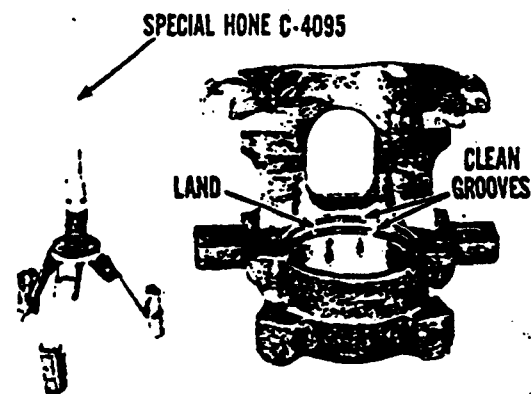


Fig. 33—Refinish and clean the bore and the grooves

USE A NEW SEAL AND DUST BOOT

Never try to re-use a seal or dust boot. When you service a caliper, always install new ones and be sure and use the special lubricant provided with the seal kit. This will make it much easier to install these rubber parts and minimize the possibility of damaging them. Don't use any other type of lubricant.

AIR PRESSURE POPS THE BOOT INTO PLACE

There is an easy way to install the dust boot. Lubricate the boot with the special lube provided and using fingers only, work the outer lip of the boot into its groove in the cylinder bore. Make sure the bleeder screw is closed and install a temporary brass plug in the pressure inlet of the caliper. Be sure the plug is brass and has the correct thread so you won't strip the threads in the caliper.

- LUBRICATE PISTON
- LINE PISTON UP
- PUSH PISTON INTO BORE

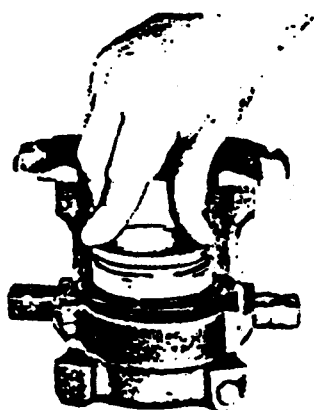


Fig. 34—Escaping air pops the boot into place

Lubricate the piston, slip it through the dust boot and line the piston up squarely and start it into the cylinder bore. Press down on the piston with your fingers and the trapped air escaping past the piston seal will pop the inner lip of the boot into the groove in the piston ... slick as a whistle.

GUIDE PIN BUSHINGS AND POSITIONERS

When new shoes are installed or the caliper is serviced, you must use new positioners and must install new rubber guide pin bushings in the caliper. New positioners are needed because the old ones closed up as the linings wore and are not re-usable. Of course, constant caliper movement gradually wears the rubber bushings so they must be replaced.

The rubber bushings for the guide pins must be installed in the caliper and fully seated be-

DON'T DO IT!

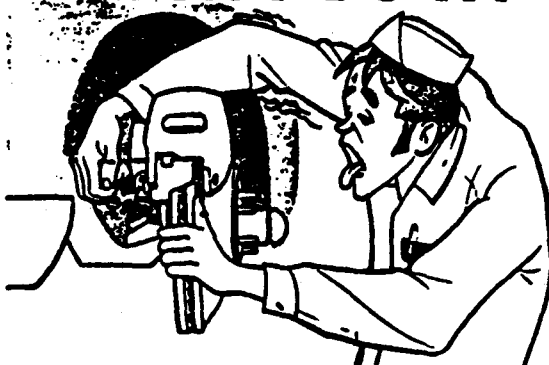


Fig. 35—Install the bushings in the caliper first

fore the pins are installed and threaded into the adapter. If, for example, you try to put the large inner bushings on the guide pins and push them into the caliper, the bushings probably won't seat properly. If you succeed in getting the pins threaded into the adapter, chances are you'll manage to ruin the bushings and collapse the positioners.

DON'T CROSS-THREAD THE GUIDE PINS

When you thread a guide pin into the adapter, make sure that the pin is properly aligned and that the outer end of the pin is started into the outer bushing. If you aren't careful at this point you could manage to cross-thread the guide pin threads. Also, make sure the locating tabs on the positioners are correctly located over the machined surface of the caliper before you tighten the guide pins.

MISCELLANEOUS BRAKE SYSTEM SERVICE TIPS

As stated earlier, your Service Manuals cover all phases of brake service in detail. However, the following hydraulic system suggestions are worth repeating for emphasis. If you ever run into a case of brakes dragging because the master cylinder won't compensate, it just could be the stoplight switch adjustment. Remember, it is a spring-loaded switch and if the plunger is too far forward it can keep the brake pedal from returning far enough to open the compensating ports. If this happens, brake fluid expansion from heat buildup can cause the brake shoes to drag.

CHECK METERING VALVE OPERATION

To quick-check the metering valve, apply the brakes gently ... car parked. A very small change in pedal effort (described by some as a slight "bump") will be felt at about one-inch of pedal travel if the valve is working right. This "bump" signals the opening of the valve plate that occurs at about 115 psi, allowing flow to the front brakes.

If you have a helper handy, you can check the metering valve visually. Watch the end of the metering valve push rod as your helper applies the brakes. The rod should move out of the valve slightly as the brakes are applied and move into the valve as the brakes are released.

BLEEDING THE BRAKES

It is a simple matter to bleed the front brakes:

simply open the bleeder screw and gravity will do the job for you. Just make sure there is plenty of fluid in the master cylinder so it doesn't run dry and let air into the system.

If you use a pressure bleeder to bleed the entire system, the front brakes won't bleed properly unless you keep the metering valve open. That's because pressure bleeders are usually operated at about 30 psi and this pressure will close the metering valve and shut off all flow to the front brakes.

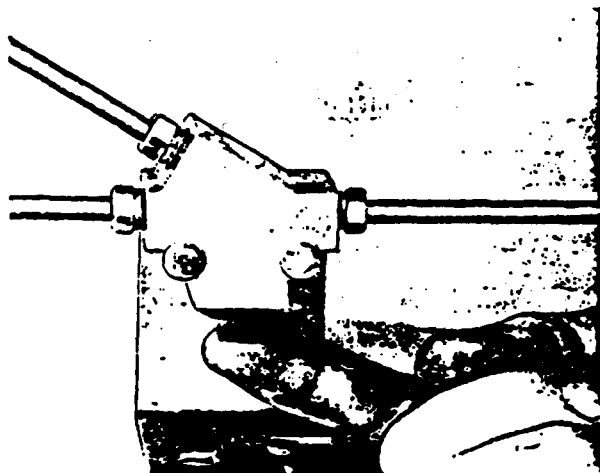


Fig. 36—Do not clamp or block the metering valve open

This situation is easily overcome. Simply hold the metering valve push rod open while bleeding the disc brakes. Do not force the push rod beyond its normal position, and never use a block or clamp to hold the valve open.

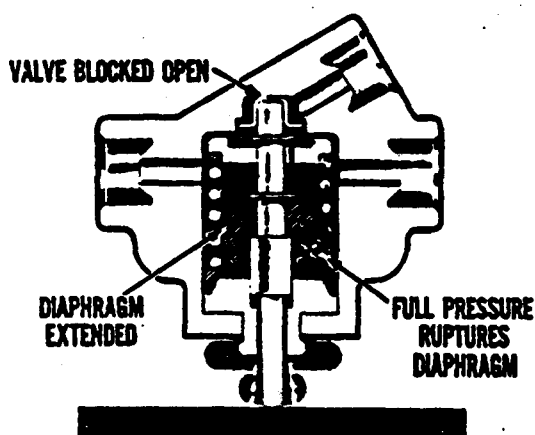


Fig. 37—If diaphragm is ruptured, fluid will be lost

Here's what could happen if you block the valve open and then forget to unblock it. When the brakes are applied, full pressure will act on the diaphragm at the lower end of the push rod. This can rupture the diaphragm and result in loss of fluid in the front brake system.

ABOUT THOSE NEW RING-MOUNT WHEELS

This note about the new wheels doesn't quite fit elsewhere but should be mentioned. A 15-JK wheel *must not* be used on a full-size 1969 model equipped with floating caliper disc brakes because this type wheel will interfere with the brake caliper. A 15-JJ or a 15-K wheel must be used with the floating caliper brake.

DO NOT USE!

OKAY

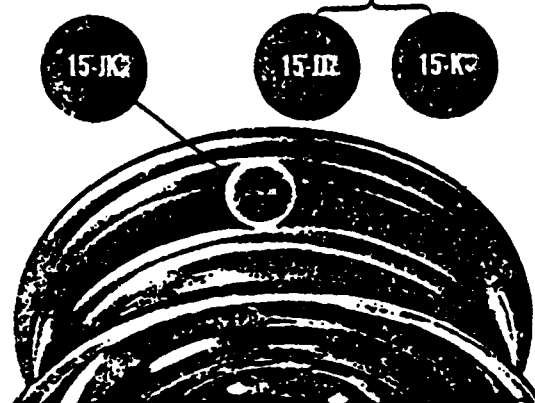
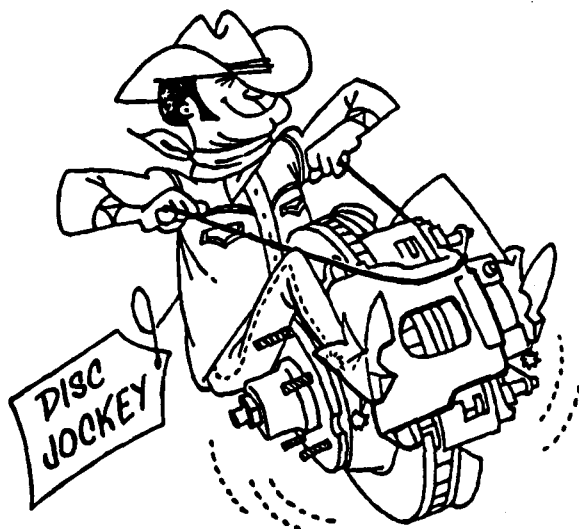


Fig. 38—Be sure and use the correct type wheel

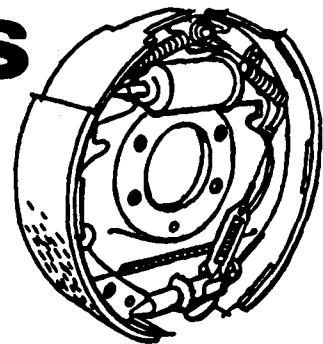


RETURN TO D. BAI

**MASTER
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69-7

**DRUM BRAKE
SERVICE
HIGHLIGHTS**



**PLYMOUTH
DODGE
CHRYSLER
IMPERIAL
DODGE TRUCK**



CHRYSLER
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GIVE THE BRAKES A BREAK...

Generally speaking, routine brake servicing is a relatively simple job. As you know, replacing worn lining, installing new hydraulic parts, or refinishing drums are everyday operations which will take care of most brake problems. But, if these simple jobs are not done properly . . . if parts are merely exchanged in a careless manner, without attention to recommended precautions, it's just like asking for trouble. Seemingly unimportant things, such as keeping the linings clean, and handling drums carefully, can easily make the difference between a good job and a comeback.

Regardless of whether you're working on a new car or one which has had plenty of use, successful brake servicing boils down to doing a *complete* job as described in your Service Manuals and Bulletins. If you stop to analyze the servicing hints covered in this Reference Book, you'll soon realize that they are simply ways of correcting conditions which are not up to specification standards.

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BRAKE CHATTER

Controlled application of friction is the basic process used in braking. Explained in simple terms, brake shoes are forced out against drum surfaces with a force proportional to foot effort on the brake pedal. This action produces the friction needed to slow or stop the wheels.

OPERATION SHOULD BE QUIET

When brakes operate in a normal manner, we get smooth, quiet braking regardless of car speed or how much force is applied to the brake pedal. However, under certain conditions, brake application produces a vibration called brake chatter.

CHATTER CAN BE IRRITATING

In most cases, chatter is a vibration in the brakes which travels to other parts of the car where it can be felt and sometimes heard. It is not a dangerous condition, but the vibration and noise can be irritating. And, to make troubleshooting interesting, chatter vibration can occur at either high or low speeds.

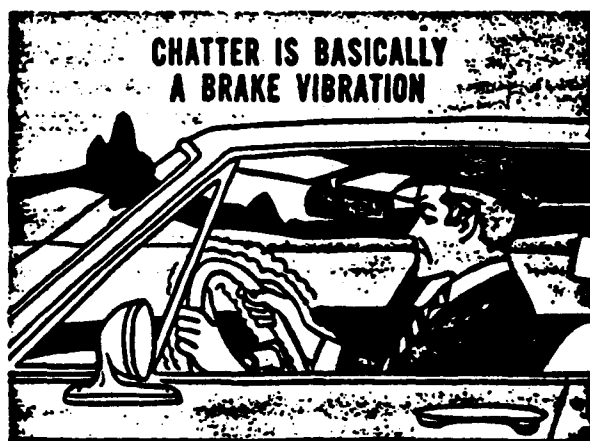


Fig. 1—Chatter can be felt and heard

IRREGULARITIES CAUSE CHATTER

Chatter is usually caused by surface irregularities, especially in front brake drums. Similar vibration in the rear brakes is largely absorbed by the suspension, so it seldom causes a disturbance. A drum surface may be wavy, oval, out of round, or spotted by overheating. We'll cover these conditions as we go along.

OTHER PARTS ALSO VIBRATE

In addition to brake drum conditions, high-speed chatter can also be caused, or made worse by a loose or bent wheel, poor wheel balance or bearing adjustment, soft tires or irregular tire treads, looseness, misalignment or improper adjustment of the steering and suspension systems.

HIGH-SPEED CHATTER CAN BE CAUSED OR MADE WORSE BY:

- LOOSE OR BENT WHEEL
- POOR WHEEL BALANCE OR BEARING ADJUSTMENT
- SOFT TIRES OR IRREGULAR TREAD WEAR
- STEERING OR SUSPENSION LOOSENESS OR IMPROPER ADJUSTMENT

Fig. 2—Other parts can also act up

ROAD-TEST DIAGNOSIS

In general, the best way to begin looking for the cause of brake chatter is with a road test. Ask the owner to ride along and point out the disturbing condition so you'll know what the actual problem is. The test will help you decide to concentrate on the brakes, or to look elsewhere for the cause of the chatter.

CHECK UNDERNEATH FIRST

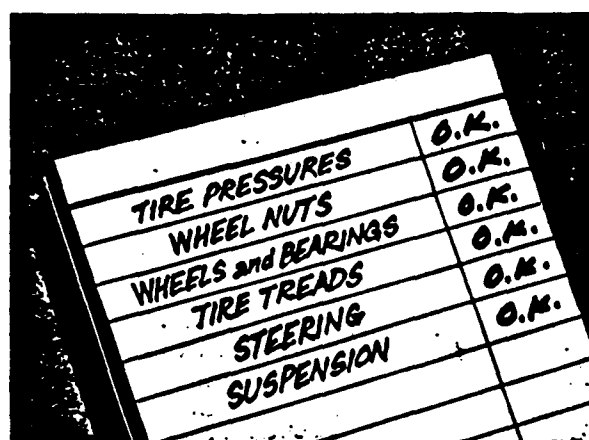


Fig. 3—Check other parts before road-testing

Before you take a car out for a test ride, give it a quick inspection to check the condition of other car parts which could cause or contribute to chatter. Make sure that tire pressures are correct, and front wheel nuts are properly torqued. Also raise the front end of the car so you can check for bent wheels, loose bearings or irregular tire treads. At the same time, check steering and suspension parts for looseness or obvious damage.

TAKE THE HIGH ROAD

To test for high-speed chatter, speed up the car above 60 m.p.h. on a smooth stretch of pavement. Then apply light to moderate brake pedal as you would when slowing down for traffic or when entering a speed zone.

CHATTER ON HIGH

If vibration begins as the pedal is first applied but is reduced or disappears below 40 m.p.h., the cause is probably a drum surface which is wavy, oval, or out of round. High-speed chatter may not come in at all on heavy brake applications, or after the drums are warmed up by the initial application. In some cars, you may hear a rumbling sound along with the vibration, especially with heavier pedal applications.

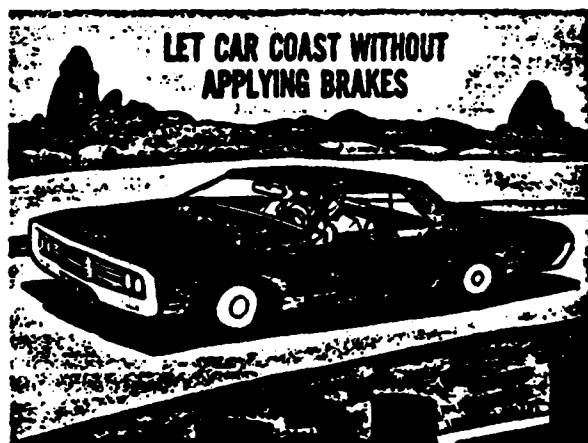


Fig. 4—Listen for car or pavement noise

STAY OFF THE BRAKES

After you check the *brakes*, bring the car back up to the original test speed on the same test stretch and let it coast down through the critical range *without* applying the brakes. Any vibration under these conditions comes from other parts of the car, or from the pavement.

IF IT CONTINUES . . .

Chatter which comes in at any speed from high, to as low as 20 miles an hour is usually caused by heat-spotted drum surfaces. Other causes can be badly worn brake lining, or new lining with improper heel and toe clearance.

CHATTER CAUSED BY DRUMS

The drum irregularity which causes chatter can be a slight waviness in the friction surface of the brake drum. This is usually a new drum condition and is *not* the same as out-of-round or oval drum distortion.

DRUMS CAN CHANGE

Even though new drums are precisely machined, the friction surface can change slightly as the drums break in, especially if the brakes get heavy use during this period. The high and low contour of the surface waviness causes uneven friction when the lining is forced against the drum. The uneven friction results in the vibration we call chatter.



Fig. 5—Uneven friction sets up chatter

DON'T WARP 'EM

Overtight or unevenly tightened wheel nuts can distort a drum and cause irregularities. This means that you'll have to be careful when using impact tools or long-handled wheel wrenches. In some cases, you can cure, or reduce brake chatter by retorquing the wheel nuts properly. However, if a drum has been permanently distorted, retorquing the wheel usually has little or no effect.



Fig. 6—Don't tighten nuts too much

FOLLOW THE PATTERN

The best precaution against tightening distortion is to tighten the wheel nuts evenly and in the proper star-pattern sequence with a torque wrench. Tighten the nuts initially to half the final torque or about 30 foot-pounds. Then in the same star-pattern sequence, tighten the nuts to 60 foot-pounds.



Fig. 7—Tighten wheel nuts in sequence

THE SURFACE MUST BE EVEN

When checking for causes of drum distortion, make sure there are no thick paint accumulations or other high spots on the wheel mounting bolt area which contacts the drum. The wheel mounting surface must be even or the drum may become distorted when the wheel nuts are tightened.

OVAL DRUMS CHATTER

Out-of-round or oval drums can also cause uneven friction which results in brake chatter. Along with the chatter, an oval drum can cause another condition called pedal pulsation which is most noticeable on light pedal applications.

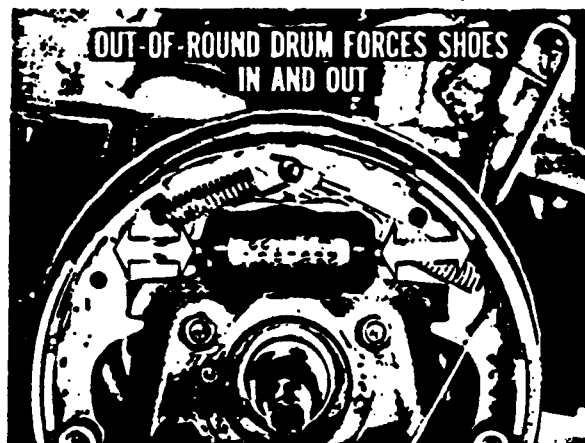


Fig. 8—Piston movement causes pulsation

SHOES PUMP THE PEDAL

The out-of-round drum forces the brake shoes in and out as it revolves. This brake shoe "pumping" action causes hydraulic pressure pulsations which can be felt at the brake pedal.

SPOT FRICTION IS DIFFERENT

Chatter which is caused by overheated areas or hard spots on the drum surface also results from uneven friction. Like the variation caused by drum irregularities, braking friction is different at hard spots, so you get chatter when the brakes are applied.

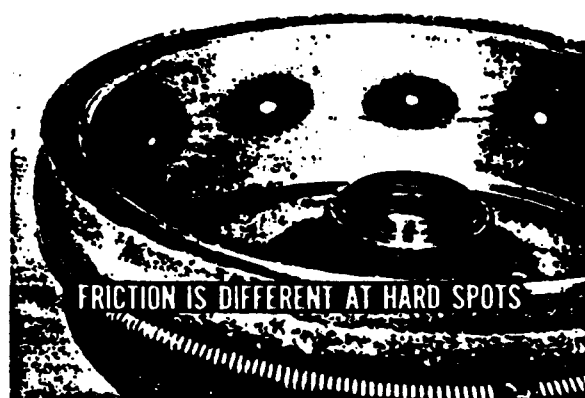


Fig. 9—Hard spots also cause chatter

HIGH PRESSURE CAUSES SPOTS

Hard spots are areas on the cast-iron drum surface which have been converted to hard steel by drum overheating. Spotty overheating is caused by excessively high lining contact pressure along the centerline or stiffest part of the shoe. This high contact pressure can result from improperly ground linings which make limited contact with the drum, linings which are substantially harder than recommended replacements, or from abuse through "burning-in" new linings.

FIRST THEY'RE BLUE

Brake drum hard spots begin as blue areas which have different friction characteristics than unaffected areas. The blue areas do not affect the drum itself, so if detected at this stage, they can be cleaned up with sandpaper or emery cloth to restore a uniform friction surface around the entire drum.

SPOTS CHANGE TO STEEL

When drum overheating continues to the stage where the unwanted "heat treatment" changes the cast iron to steel, the converted areas show up as silvery spots in the centers of the blue areas. Since these severe hard spots are more wear-resistant than surrounding areas, they affect the wear pattern as well as the braking friction characteristics.

MAKE 'EM ROUND

Irregular, oval, or heat-spotted front brake drums can usually be machined to restore the friction surface to specification standards. For the first two conditions, we remove just enough material to eliminate the waviness and to make sure the drum surface is truly round.

NEW DRUMS MAY BE BETTER

Severe hard spots can be smoothed off with a grinder, but it may be better to install a new drum to correct this condition. Grinding can smooth the surface, but the friction variation can return after the drum is put back in service. Hard spots usually affect the lining, so with a new drum, we also reline both brakes and sand the opposite drum surface so braking action will be even.

WHEEL AND DRUM TOGETHER

You can minimize distortion when machining a drum if its wheel is attached and properly

torqued when you do the job. Follow the same tightening sequence used when the assembly is on the car. Leave the wheel nuts undisturbed after machining, and when you install the wheel and drum on the car. When you machine a drum with the wheel attached, it's a good idea to mark the wheel and a mounting stud. That way, you can replace the wheel in the original position later on if it is removed.

MAKE THE SURFACE SMOOTH

If you use a drum lathe to refinish drum friction surfaces, make sure the cutting tool is sharp and set to cut smooth. We want a uniform surface with a dull finish, so don't forget to break up any machining pattern with sandpaper or emery cloth.



Fig. 10—Use moderate feed when machining drums

DON'T OVERDO IT

Regardless of whether you use a cutting tool or a grinding wheel, be sure you do not overfeed. In a heavy cut, the tool can follow the original surface irregularities and you'll reproduce essentially the same condition you were trying to correct. With too much grinding feed, the stone only wears faster, and you can distort the drum by overheating.

STAY WITHIN LIMITS

Never enlarge the total brake drum diameter more than .060" over the standard measurement, or you'll need a new drum. This means that the tool or grinder must not be fed in more than .030" to clean up the surface. Most chatter conditions only require light machining anyway, so just remove enough metal to get rid of

the drum surface irregularities, or any oval, out-of-round condition.

DRUMS MUST BE CLEAN

After machining, be sure to remove all cuttings or abrasive material from the drum. Remember that it is very important to keep the drum, especially its friction surface, absolutely clean. Only a small amount of oil, or grease from hands, wiping cloths, or even compressed air can get on the lining and cause brake problems **RIGHT NOW**. Brake fluid on linings can also cause trouble.



Fig. 11—Don't bang drums around

HANDLE WITH CARE

In any service operation involving brake drums, on or off the car, be sure to handle the drums carefully. They are built to take full braking loads, but you can cause distortion if you bang them around, especially if you drop one on a hard surface.

CHATTER CAUSED BY LINING

As mentioned earlier, brake chatter can also result from badly worn linings. Here, the first step is obvious, new or relined shoes must be installed. But, don't take a chance on causing uneven braking by relining only one brake. Reline them in pairs—both fronts or both rears.

CLEARANCE OR CHATTER?

Before installing the brake shoes, make sure that the radius of the new lining is not too large for the drum. If there's not enough clearance at the ends of the linings, you may be building in chatter instead of correcting it.

HEEL AND TOE CLEARANCE

To check lining radius, hold the shoes in the drums with the lining against the drum surface. You should have at least .004" clearance at both ends of the lining so it will contact the drum in the middle area first to assure full lining contact when the brakes are applied.

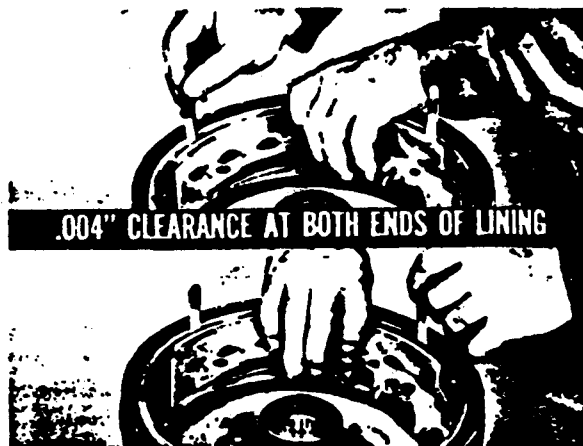


Fig. 12—Lining radius must be correct

USE TWO BLADES

Insert and hold a .004" feeler blade between the drum and lining at one end while you check the opposite end so the shoe will not rock during the clearance check.

TRY GROOVED LININGS

When you reline to correct chatter in our 11" front brakes with non-ribbed drums, you can get better results with the new, grooved-type primary linings. You can use plain-surface pri-



Fig. 13—Less chatter with grooved lining

mary linings, but do not risk uneven braking by using grooved lining in one brake and plain lining in the other. Use the same type of lining for both primaries to play it safe.

GROOVED LINING A MUST

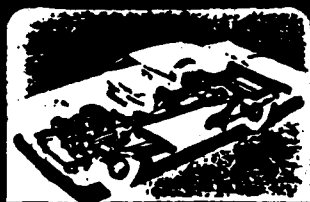
You can use grooved or plain primary lining with non-ribbed front drums, but only grooved-type primary lining should be used for replacement on our 11" brakes with ribbed drums. If you install plain-surface lining on these brakes, it will change the brake characteristics and may cause chatter.

CHATTER FROM OTHER PARTS

As mentioned earlier, vibration which can cause chatter or make it worse may result from below-standard conditions in other parts of the car. Wheels must run true and be properly aligned. Correct wheel balance and bearing adjustment are also important. And don't forget that improperly inflated tires or those with irregular tread wear can also cause vibration. All steering system parts must be in good condition and properly adjusted. Make sure the suspension bushings and ball joints are okay and that the strut bushing nuts on both sides are properly torqued.

ELIMINATE OTHER POSSIBILITIES

Once again, the reason for checking wheels, tires, steering and suspension is to eliminate them as possible causes of chatter. In any event, do not attempt to cure chatter by tampering with suspension design because un-



- STEERING PARTS IN GOOD CONDITION AND ADJUSTED
- WHEEL ALIGNMENT AND BEARINGS OK
- SUSPENSION PARTS IN GOOD CONDITION
- STRUT BUSHING NUTS PROPERLY TORQUED

Fig. 14—Check other car parts

authorized alterations can affect the steering and change ride characteristics. You can be sure that if a suspension design change could stop chatter, it would be made at the factory.

PREMATURE LINING WEAR

The length of brake lining life depends a great deal on the way the car is driven. Usually, linings last for more miles on cars used mostly on the open highway where stops are few. But even here, lining life can be cut drastically by driver abuse, such as unnecessary panic stops or pedal riding.

DRAG CAUSES WEAR

Other causes of premature lining wear are mainly mechanical, non-standard conditions which cause linings to drag on the drums when the brakes are released. Since brake lining drag may be continuous as well as intermittent, brake overheating can also get into the act, so you may find evidence of both conditions. Most causes of lining drag are the same in front and rear brakes, with the exception of conditions which affect the operation of the parking brake system.

MECHANICAL CAUSES VARY

Premature lining wear can be caused by over-adjustment, improper adjustment, incomplete shoe return, lining contamination, faulty wheel cylinder operation, incorrect lining, or improper brake shoe installation. And, as mentioned earlier, brake lining life can be shortened by unnecessary heavy usage or pedal riding.

BRAKE OVER-ADJUSTMENT

A brake can over- or under-adjust if the automatic adjuster cable is bent, or not installed properly. Misalignment shortens the cable and this causes the improper adjustment. Just make sure that no cable ends are kinked when they're hooked up.

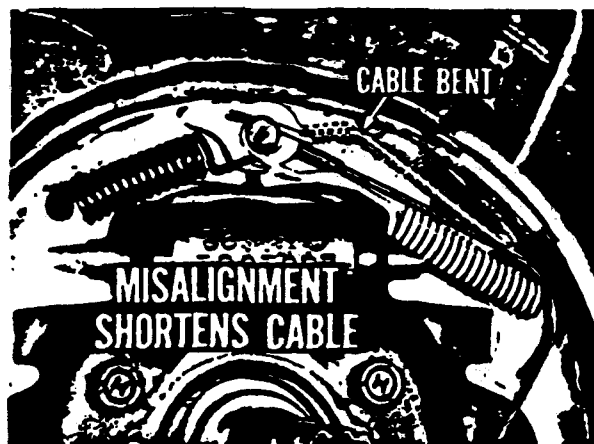


Fig. 15—Cable ends must be straight

USE THE RIGHT HOOKUP

If you install a new brake adjuster overload spring, make sure that the spring hooks face outward. Replace broken springs with the new type which is painted green or blue for identification. You can use the new springs on early type adjusters with spring holes or on the slotted type, but be careful that you don't bend the hooks out of shape when you install a spring on the early type adjuster.

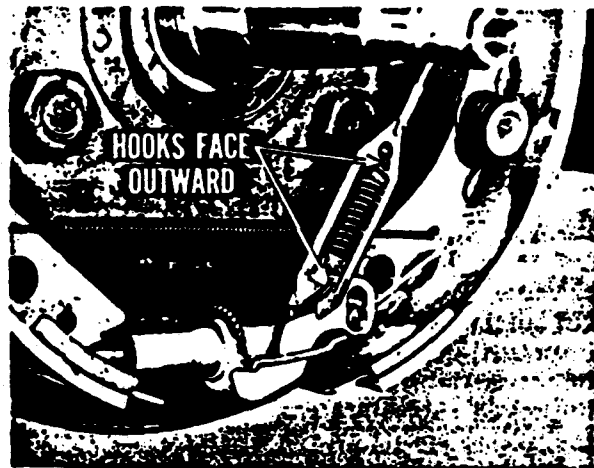


Fig. 16—Improved spring is green or blue

SHOES FOLLOW DRUM CONTOUR

A brake can also over-adjust if the drum is badly out of round, or off-center. Here, when the brakes are applied, the shoes move back and forth as they follow the drum contour. This movement can cause the automatic adjuster to expand and over-adjust when it's not needed.

For proper adjuster operation, the total out-of-round indication of any drum should not be more than .006" of an inch.

CHECK JAMMED DRUMS

You may find a rear drum which is slightly distorted and jammed on the mounting studs. This condition should alert you to look for an axle shaft bolt circle and drum pilot, or mating drum holes which are not concentric. In either case, a new drum will be needed because the jammed-on drum is either distorted or improperly machined. First try a new drum, but if you find interference at one point on the flange shaft, even after trying different stud holes, the axle shaft may be the cause. A non-concentric drum will cause pilot interference in all stud positions.

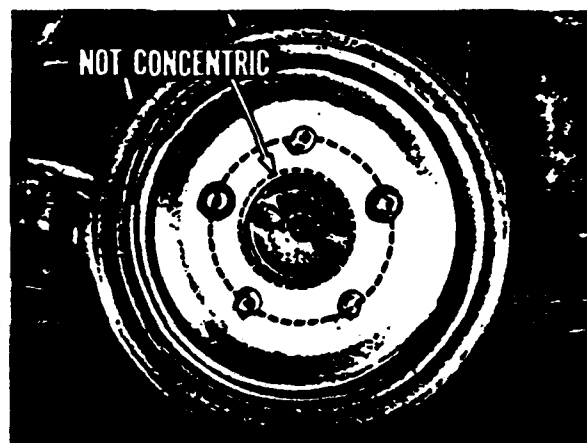


Fig. 17—Axle flange and drum must be concentric

WOBBLY DRUMS CAUSE WEAR



Fig. 18—Drum wobble can cause brake drag

If a rear brake drum or axle flange has too much runout, the linings can also wear out in a hurry. Over-adjustment is no problem with this condition, but a wobbly drum can cause lining drag and unnecessary wear, even when the shoes are fully retracted.

IMPROPER BRAKE ADJUSTMENT

The improper brake adjustment we are concerned with here is basically a parking brake condition. The main point to keep in mind is that linings can drag and wear rapidly if the parking brake adjustment is either too tight or too loose. When you relined brakes, always remember that the parking brakes must be adjusted after the service brakes. If you reverse this sequence, the parking brake adjustment will probably be too tight.

RELEASE THE LEVER

To check the parking brake adjustment for being too tight, first make sure that the brake operating lever is fully released. Any sticking or binding in the lever mechanism or its cable must be corrected before you check or adjust the parking brakes.

CHECK FOR END-PLAY

On both brakes, seat the shoes against the anchors if necessary. With the shoes seated, there should be a slight amount of end-play at the strut in either or both brakes. If neither strut shows end-play when you try to move it with your fingers, the parking brake adjustment is too tight.



Fig. 19—Try to move strut with fingers

SPRINGS CAUSE DRAG

At the other extreme, if the parking brake adjustment is too loose, the adjuster cable return spring can extend far enough to move the strut operating lever and the secondary shoe rearward in either or both rear brakes. The spring force causes the lining to drag and wear rapidly. While you have the drums off, it's a good idea to check the parking brake struts, levers and cables in both brakes to make sure there's no sticking or binding which could interfere with full release of the brake shoes.

HEAT WEAKENS SPRINGS

Be sure to check both parking brake cable return springs for signs of heat damage. A spring that has been overheated may not release the cable and the shoes properly. If there's any doubt about the condition of the release spring or cable, install a new cable assembly.

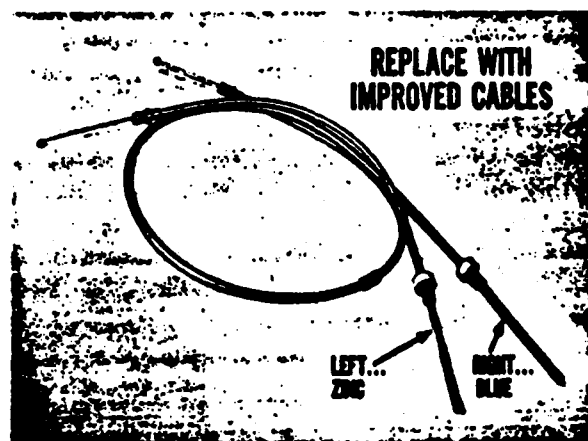


Fig. 20—Improved cables have stronger springs

INSTALL THEM IN PAIRS

On our 11" brakes, it's best to replace with the improved-type brake cables because they have improved lubrication and stiffer springs. The improved cables are easy to identify because the release spring on the assembly for the left side is zinc-colored, while the one for the right side is blue. Always install them in pairs. If you use an improved-type cable along with an original cable, with a black-colored spring, you can cause an unbalanced condition which can result in brake drag.

REPLACE WEAK RETURN SPRINGS

Weak or damaged shoe return springs in any brake can also result in brake drag and rapid

lining wear. Any time you find return springs which are discolored by heat, or with stretched or distorted end coils, be sure to replace them with new ones.

HOLD-DOWNS ARE ALSO AFFECTED

If brake shoe return springs are heat-weakened, you'll probably find that the shoe hold-down springs are also affected, and should be replaced. Regardless of whether they are new or used, do not stretch hold-down springs in an attempt to increase their tension. Stretching can produce added spring load which will make the shoes hang up on the support plate and cause brake drag.

ELIMINATE IRREGULARITIES

When you reline, or if you suspect that brake shoes do not return properly, be sure to check the contact areas on the brake support plate. Also check contact tabs or loops on the shoes. These areas must be free of burrs or grooves which could cause the shoes to hang up. If necessary, you can use a fine-cut file to clean up any contact area irregularities.

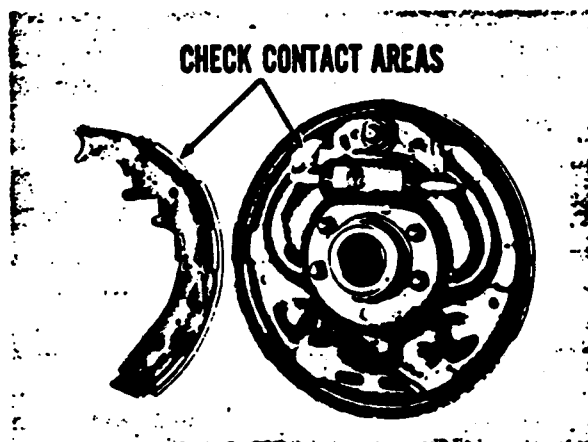


Fig. 21—Contact areas must be smooth

LUBE THE CONTACT AREAS

When you install new or relined shoes, always put a thin coat of approved lubricant on the brake support plate platforms. But don't get the lube on the linings or the job will bounce back into the shop.

KEEP THE BIRDIES QUIET

In connection with support plate platform lubrication in rear brakes, you'll probably find

the shoe contact areas dry if there's a repeated "chirp" noise when you apply light force on the brake pedal. The chirp results from slight back and forth movement of the shoes and can usually be corrected by lubing the support plate contact areas.

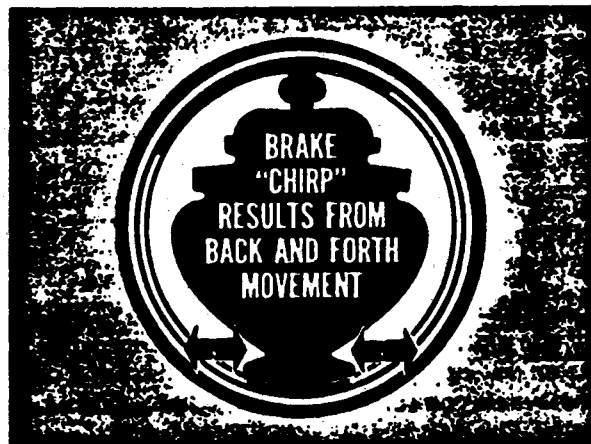


Fig. 22—Lube platforms to cure "chirp"

BRAKE LINING CONTAMINATION

Anything that changes brake lining friction characteristics can change braking action in general, and may also cause the braking to be uneven. You are familiar with the fact that water can literally "wash-out" braking action until the linings are dried out. On a more permanent basis, oil, grease or brake fluid on the lining can make a shoe grab or slip each time the brakes are applied. Grabbing also causes brake pull toward the side with the contaminated lining. If a shoe slips, the brake on the opposite side works harder, causes pulling toward that side and wears out sooner.

CONTAMINATION RUINS LINING

In addition to careless handling, lining contamination can also result from leakage at axle shaft seals, front wheel bearing seals, or leaky wheel cylinders. Contaminated lining must be replaced when the other repairs are made. Any attempt to re-use such lining will result in continued grabbing or slipping.

USE ONE AT A TIME

If you mix different types of front wheel bearing lubricant, the mixture can become runny and thin enough to leak past the seals onto the lining. This condition can occur even when both



Fig. 23—Don't mix wheel bearing lube

lubes are approved types, so be sure to wash out all the old lube before you repack the bearings. As an added precaution, be sure to install a new seal when you remove a bearing for any reason.

FAULTY WHEEL CYLINDER OPERATION

The wheel cylinder pistons must be free to move in and out so the apply pressure on both shoes will be equal. This freedom of movement also permits both shoes to retract completely after each brake application.

THE POINT OF NO RELEASE

A sticky or jammed piston can hold a brake shoe out in the applied position even after the apply pressure is released. Normally, the return springs retract the shoes, but when a sticky piston prevents shoe return, the lining will drag and wear rapidly.

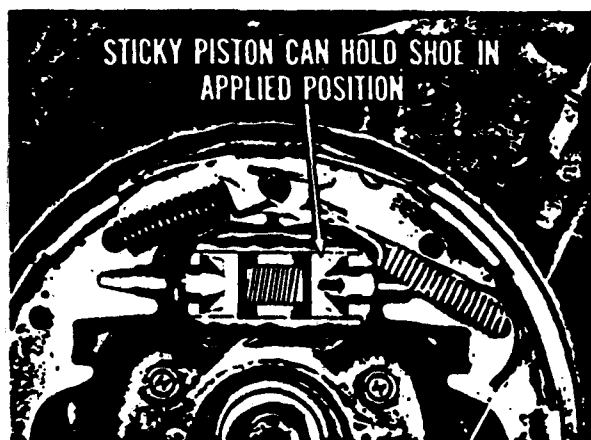


Fig. 24—Non-retracting shoe causes brake drag

THE SHOE STAYS PUT

A piston which is stuck in the return position, does not move its shoe outward and you lose quite a bit of the braking force at that wheel. This loss makes the *other* brakes work harder, so *their* lining wears faster than normal. The good brakes can also cause a pull to one side, especially when the front brakes are involved.

IT'S STUCK BY CORROSION

Usually, you'll find that corrosion is the cause of sticky or jammed wheel cylinder pistons. This corrosion can be the result of water or splash which gets past damaged or deteriorated wheel cylinder boots. When you look for causes of uneven or excessive brake lining wear, be sure to inspect the boots for damage, and wherever possible, look for water or evidence of corrosion under the boots.

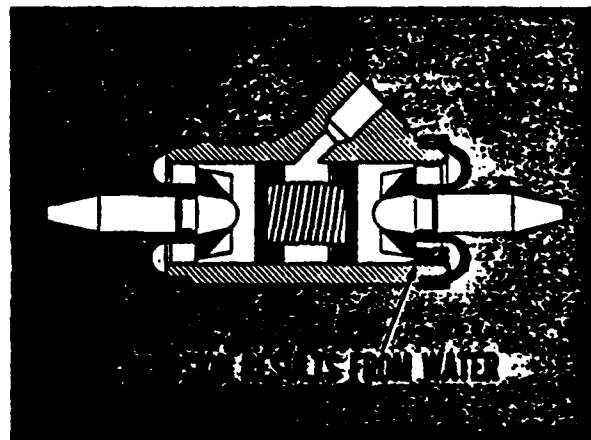


Fig. 25—Water in fluid corrodes surfaces

MOVE 'EM BACK AND FORTH

You can check for sticky or jammed wheel cylinder pistons by moving the push rods after the shoes are removed. Protect your fingers with gloves or a shop towel, and move the push rods back and forth to the limits of the boots. If you feel any roughness or resistance to movement, you'd better remove the boots and inspect the pistons.

BRAKE FLUID LIKES WATER

Hydraulic system parts can also corrode from the inside as a result of water in the brake fluid itself. In or out of the system, brake fluid must be kept free of water and absolutely clean, or brake problems will develop. Strange as it

may seem, brake fluid soaks up moisture like a blotter. In fact, fluid which is exposed to moist air only a short time, will boil and form vapor pockets in the brake system at relatively low operating temperatures. Because this vapor is compressible, it will cause loss of system operating pressure.

KEEP CONTAINERS CLOSED

It's a good shop practice to keep all brake fluid containers closed airtight when they're not in use on a job. Also wipe the dispensing spout and top of the container clean before you pour out fluid so you won't pick up dirt in the fluid. Be sure that your brake bleeder tank is the type which isolates the air from the fluid. After all, a compressed air hose can pump in plenty of water even if it has a filter.



Fig. 26—Keep fluid container closed

CHECK PART NUMBERS

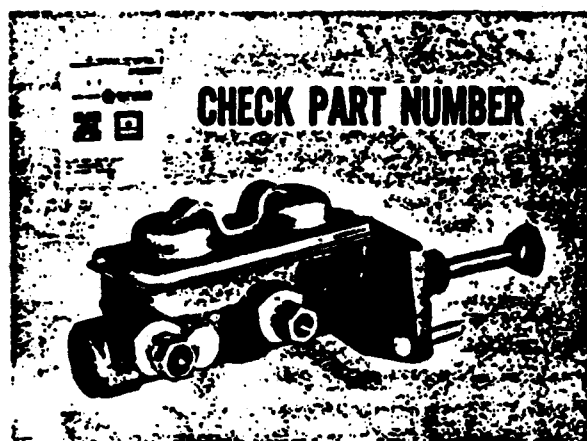


Fig. 27—Use correct master cylinder

Before we leave the hydraulic system here's a pointer on master cylinders. When you replace a master cylinder, always check the part number to make sure you're installing the correct assembly. Some master cylinders look alike on the outside, but have different front and rear displacements, so it's possible to install the wrong unit. The handy chart in the back gives the correct part numbers of master cylinders used on current models.

INCORRECT BRAKE LINING

The main fact to remember, if other types of lining are considered for installation, is that the lining on our original equipment and Chrysler replacement shoes is tailored to each model's braking requirements. Different lining can change the car's original braking characteristics, may wear faster, and if too hard can cause heat spotting on the drums.

LOOK-ALIKES ARE CONFUSING

Another reason for using approved shoes is possible interference in the fit of shoes obtained from an outside source due to minor dimensional differences. There's enough similarity in the appearance of our shoes and those used on competitive make cars that there could be a possible mixup.



Fig. 28—Shoes from other sources may bind

IMPROPER BRAKE SHOE INSTALLATION

Generally speaking, improper brake shoe installation simply means that someone is not following the procedure described in the Service Manuals and Bulletins. Here, we are concerned with such things as installing shoes

without checking the lining radius and hooking up the adjuster cables incorrectly.

SPRINGS MUST BE OKAY

When installing new or relined brake shoes, be sure to replace heat-damaged or distorted springs with new ones. Always install the primary shoe return spring before the secondary to prevent spring anchor pin damage and possible brake clunk. If a spring anchor is bent or distorted by incorrect spring installation, it may break off later on. Since brake shoe hold-down springs are also affected by brake overheating, they should be replaced if necessary.

LOOSEN THE ADJUSTER

Before installing rear drums, always loosen the parking brake adjustment far enough to get plenty of end-play at one of the brake operating struts. This will prevent interference and possible brake drag when the rear service brakes are adjusted. After adjusting the service and parking brakes it's good practice to test-drive the car.

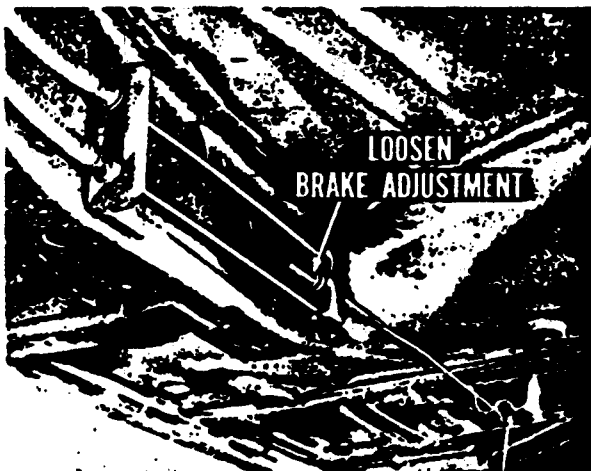


Fig. 29—Adjust parking brakes last

OLD-WIVES' TALES

You can forget anything you have heard about the need for "burning-in" new linings. This old practice only causes trouble and can ruin both linings and drums. To protect new linings from abuse, the owner should be cautioned against unnecessary, heavy brake usage immediately after a reline. A moderate-usage break-in of about 100 miles will pay off in longer lining life and lower maintenance costs.

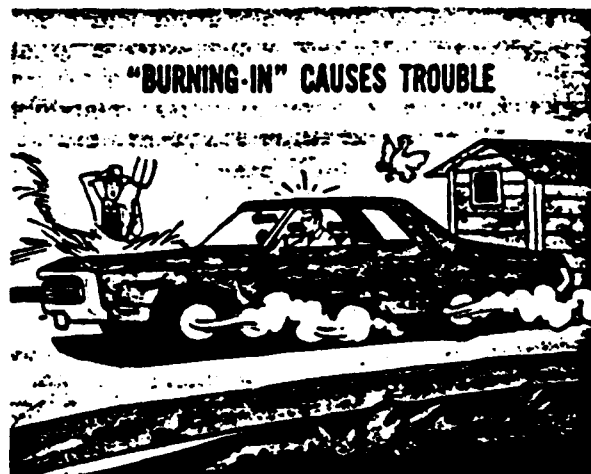


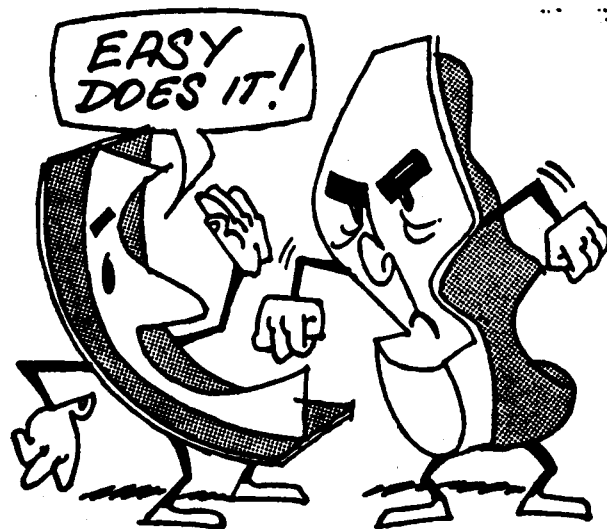
Fig. 30—Protect new linings from abuse

DRIVER ABUSE

We now come to the final cause of premature brake lining wear—driver abuse. This can range from habitual pedal riding to driving practices which require frequent panic stops. Boiled down to simple terms, driver abuse can be any continued driving procedure which causes the brakes to drag or overheat.

TELL 'EM WHY

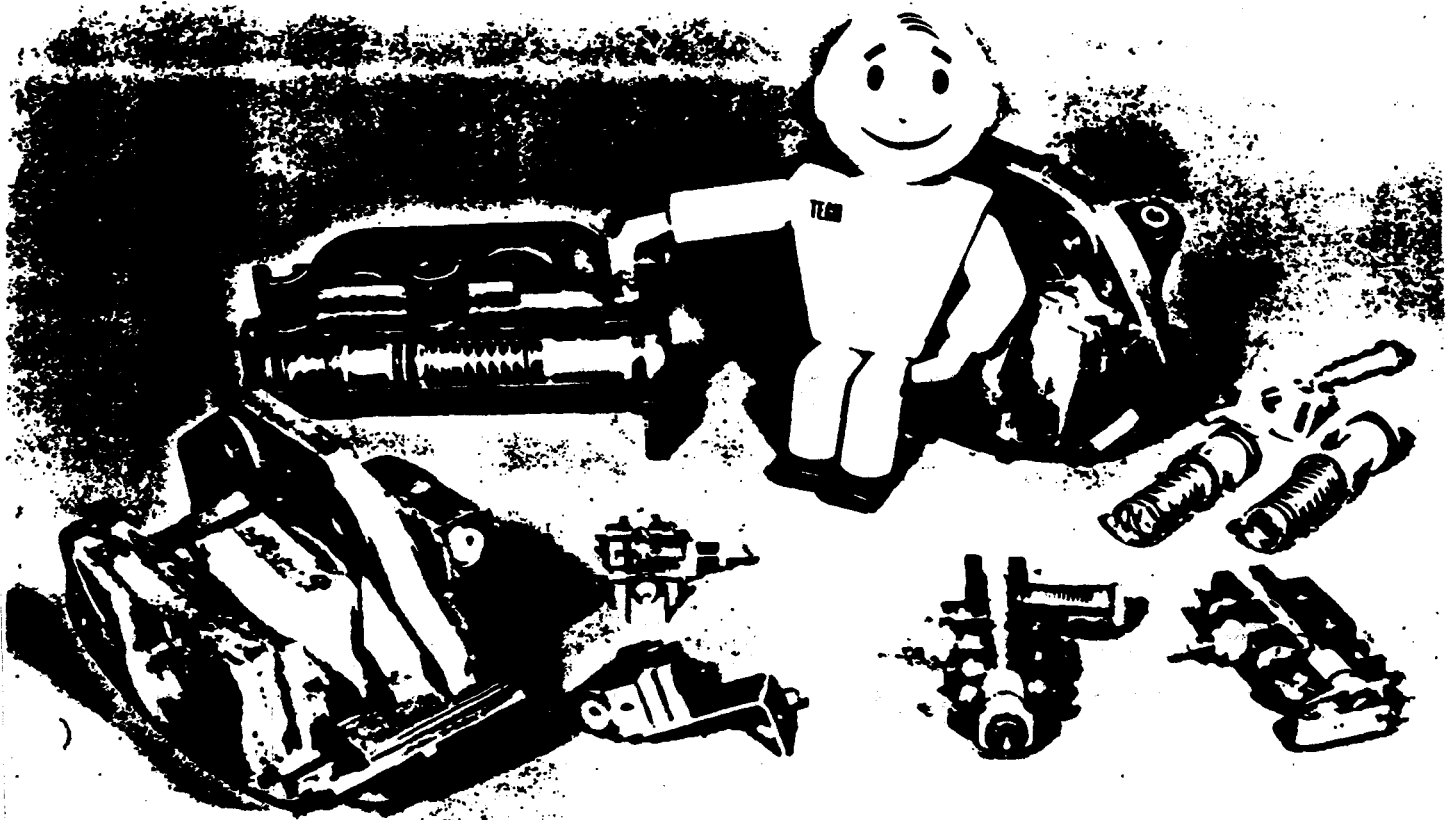
Here, instead of tools, you'll need the power of persuasion to correct the condition. Usually, a little appeal to a customer's pocketbook sense will either bring about a change in driving habits or acceptance of the consequences.



**-1969 MODEL
REPLACEMENT MASTER CYLINDER IDENTIFICATION CHART**

BRAKE TYPE	REPLACEMENT CYLINDER PACKAGE PART NO.	IDENTIFYING FEATURES			
		COVER RETAINER	BORE END STAMP	WHITE PAINT MARKING	LINE CONNECTIONS
9" & 11" DRUM— MANUAL & POWER	2808599	BOLT	—	—	OUTBOARD
10" DRUM—MANUAL & POWER ALL EXCEPT SUBURBANS WITH POWER	2808577	BOLT	—	ON LINE PORTS	OUTBOARD
10" DRUM— POWER SUBURBANS ONLY	2944269	BAIL	D	—	INBOARD
KELSEY-HAYES DISC	2808600	BAIL	A	OVER A	OUTBOARD
BENDIX DISC— (NOT WITH 426-V8)	2883058	BAIL	B	—	INBOARD
BENDIX DISC— (WITH 426-V8)	2944376	BAIL	B	—	OUTBOARD
FLOATING CALIPER DISC	2883089	BAIL	—	—	OUTBOARD
BUDD DISC	2881870	BAIL	C	—	OUTBOARD

NOTE: Above list does not cover Police or Taxi vehicles, cars with the Trailer Tow-
ing Package or other optional equipment. Check your Parts Catalog listings.



REFERENCE BOOK

8

'70

BRAKE RECONDITIONING

RETURN TO PAUL GRITT

PLYMOUTH • DODGE • CHRYSLER • IMPERIAL • DODGE TRUCK



CHRYSLER
MOTORS CORPORATION

BRAKE RECONDITIONING

Every year, Chrysler Corporation automobiles and trucks enter the marketplace with new features for prospective customers . . . and new challenges for you, the Service Technician. Usually, though, you don't get into a major overhaul until the car is a couple of years old.

Take brake reconditioning for instance - the 1971 Service Manual is probably referred to for information more than the 1973 Service Manual. The 1971 models have been driven for thousands of miles and the brake linings are ready for replacement.

So, rather than discuss the 1973 brake systems in great detail, let's backtrack a few years and recap some of the things you're more likely to run across during a normal workday on past models.

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MTSC 73

INTRODUCTION

Chrysler Corporation vehicles either have drum brakes front and rear or disc brakes on the front and drum brakes on the rear.

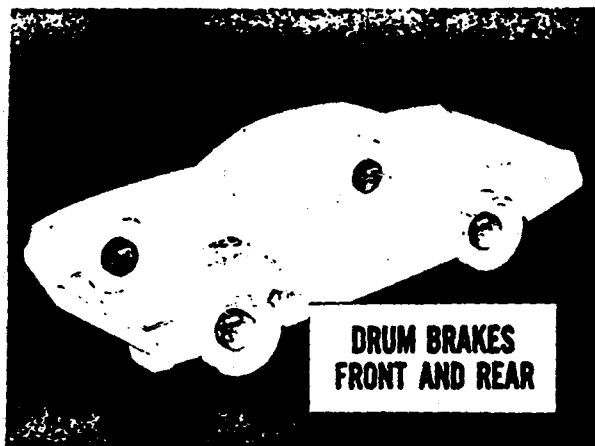


Fig. 1—Drum brakes front and rear

The two brake systems are similar in that they both begin with brake pedal effort to transmit a hydraulic force to the hydraulic cylinders at each wheel which pushes the brake shoes or pads against the drums or discs to slow or stop the car.

The brake systems on Chrysler Corporation vehicles have changed considerably over the past ten

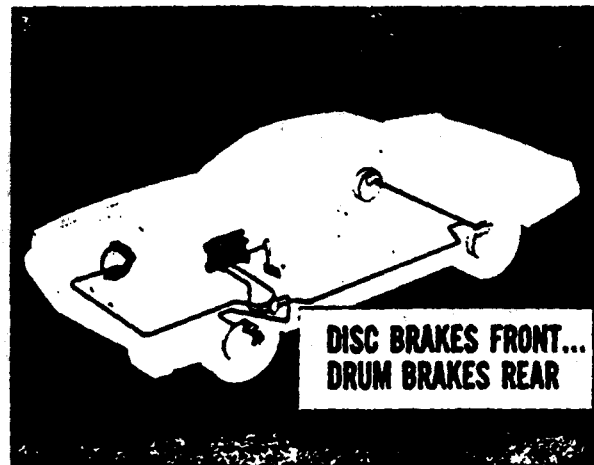


Fig. 2—Disc brakes front, drum brakes rear

years. Ten years ago, for instance, the only hardware between the master cylinder and the wheel cylinders were the brake lines and a couple of tees. The introduction of the dual brake system and disc brakes changed all that.

The dual brake system led the parade of changes with the tandem master cylinder. The tandem master cylinder has two separate fluid reservoirs arranged one behind the other in one housing and two separate pistons that operate in tandem in a

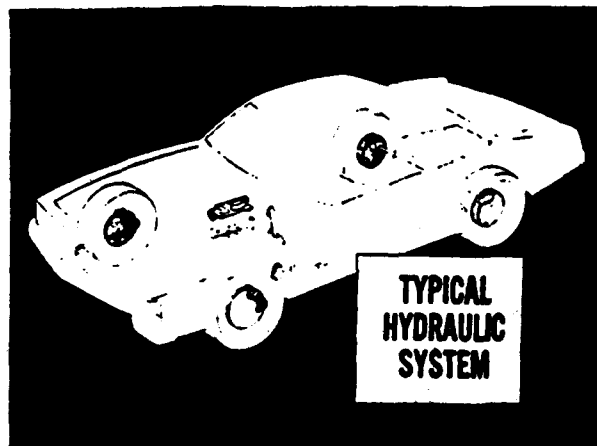


Fig. 3—Dual brake system

single cylinder bore. The purpose of the tandem master cylinder is to separate the hydraulic systems for the front and rear brakes, to insure that loss of pressure in one system will not affect the hydraulic pressure in the other system. The piston at the front of the master cylinder creates hydraulic pressure for the rear brakes and the rear piston creates hydraulic pressure for the front brakes.



Fig. 4—Previous M.T.S.C. Sessions

The dual hydraulic brake system is covered in great detail in the Master Technicians Service Conference session number 67-3. In fact, previous MTSC sessions are excellent sources for detailed coverage of Chrysler Corporation vehicle brake system improvements: Disc Brakes were featured in session number 67-4; Floating Caliper Disc Brakes in session number 69-4; Brake Hydraulics in session number 70-9; and Disc Brake Service Roundup in 72-4.

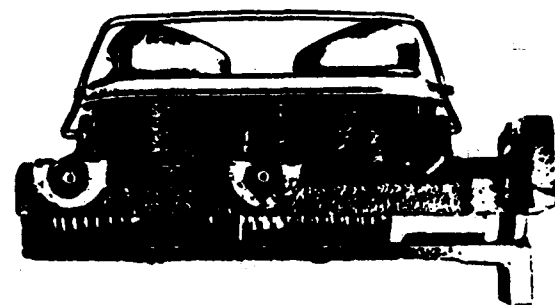


Fig. 5—Drum brake master cylinder

MASTER CYLINDER FOR DRUM BRAKES

It is important to note the characteristics of master cylinders used for brake systems with drum brakes front and rear. First, the front and rear fluid reservoirs are approximately the same size. A master cylinder used for disc brakes front and drum brakes rear has a large reservoir for the primary side of the system and a smaller reservoir for the secondary side of the system.

When you take a master cylinder used for drum brakes front and rear apart, look for a residual valve behind each of the outlet port fittings. Use an easy-out to remove the valve seats. The residual valves and springs are behind the valve seat.

The residual valves play an important role in the brake hydraulic system. They prevent air from being sucked past the wheel cylinder cups into the wheel cylinder when the brake pedal is released rapidly. When the brakes are released, fluid flows out of the wheel cylinders and back to the master cylinder. This unseats the residual pressure valve which allows brake fluid to flow into the master cylinder. When the fluid pressure from the wheel cylinders reaches about fifteen pounds, the spring behind the residual valve pushes the valve against the seat. So, there is about fifteen pounds of residual pressure in the brake lines between the wheel cylinders and the master cylinder. This residual pressure keeps the lips of the wheel cylinder cups expanded against the wheel cylinder bore.

You will notice the outlet ports are marked "R" and "F" to designate which set of brakes



it serves. Also, the brake line fitting nuts at the front and rear outlets are different sizes. This eliminates the possibility of connecting a brake line to the wrong outlet.

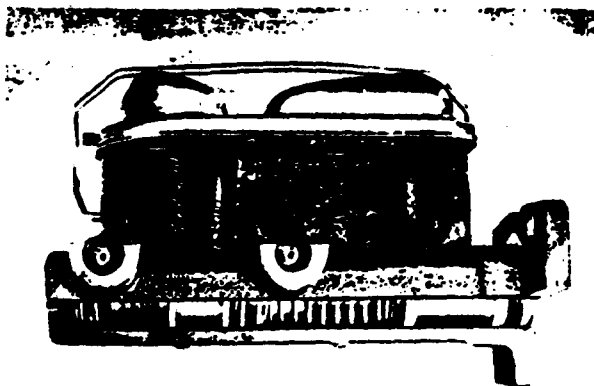


Fig. 6—Disc brake master cylinder

MASTER CYLINDER FOR DISC BRAKES

The disc brake master cylinder and the drum brake master cylinder are designed to perform differently and cannot be interchanged. The disc brake master cylinders have larger primary reservoirs. The primary reservoir has a larger brake fluid capacity because the disc brake pistons in the calipers are larger than the drum brake wheel cylinder pistons, so more fluid is required. More fluid is also needed for disc brakes because as the lining begins to wear thin the area in the caliper cylinder increases.

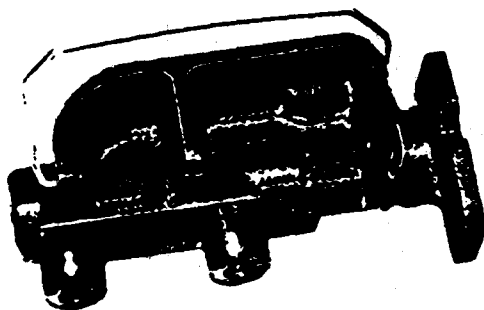


Fig. 7—No residual valve in primary side

Another difference between the drum brake master cylinder and the disc brake master cylinder is there is only one residual valve in the disc brake master

cylinder. Disc brakes have a retracting seal instead of return springs to draw the lining away from the disc when the brake pedal is released. The seal around the piston pulls the piston back into the cylinder bore to break the contact between the lining and the disc. If a residual valve was used in the primary side of the master cylinder, the residual pressure would prevent the seal from retracting the disc brake pad and cause the brakes to drag. That's a good point to remember if a customer complains of dragging front disc brakes — remove the line from the primary side of the master cylinder and make sure a residual valve has not been installed behind the outlet port valve seat.

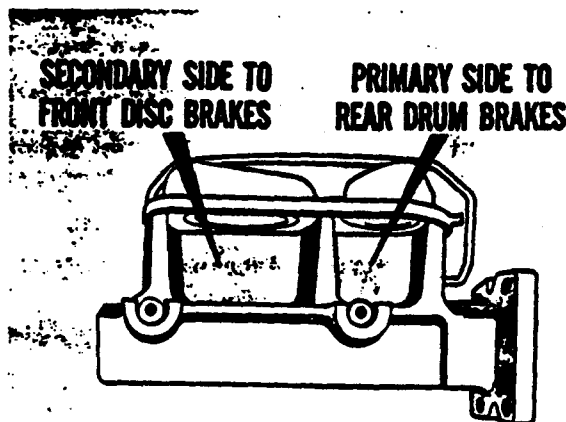


Fig. 8—Truck master cylinder — disc brakes

SOME TRUCK MASTER CYLINDERS ARE DIFFERENT

Some truck master cylinders for disc brakes have the larger reservoir and the smaller reservoir re-



Fig. 9—Hydraulic safety switch



versed — the smaller reservoir which supplies fluid to the rear drum wheel cylinders is in the primary position and the larger reservoir which supplies pressure to the front disc brakes is in the secondary position. The outlet ports are marked "F" and "R". Pay particular attention to this difference when you're working on truck brake systems.

HYDRAULIC SAFETY SWITCH

Since the front and rear brake hydraulic systems function independently in the dual brake system, a hydraulic system safety switch is used to warn the driver if one of the hydraulic systems has failed.

The hydraulic safety switch functions as both a junction for the brake lines from the master cylinder to the wheel cylinders and a warning switch. A barbell-shaped double piston with an "O" ring on each end separates the front and rear brake hydraulic systems. Two small coil springs keep the piston centered as long as pressure is the same in both systems. If pressure is lost in one system, pressure from the other system pushes the piston off center. As soon as the piston moves far enough to touch the insulated electrical contact, the ground circuit is completed and the warning light in the instrument panel comes on to warn the driver of the malfunction.

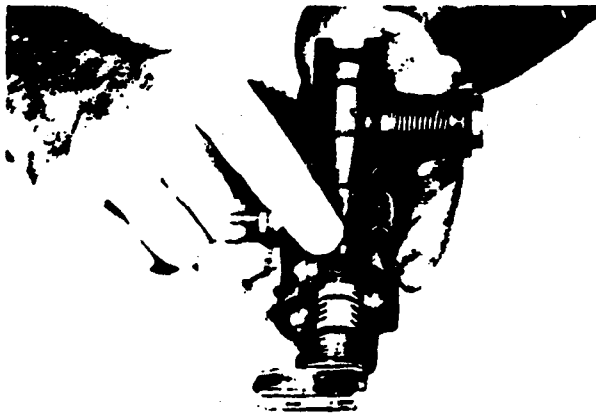


Fig. 10—Metering valve

METERING VALVE

Some cars with disc brakes are equipped with a metering valve. The purpose of the metering valve is to reduce front wheel braking on icy or extremely slippery road conditions. The valve delays the action of the front disc brakes until the rear drum brakes can take hold. The metering valve is serviced as an assembly.

To check the metering valve on a car with manual brakes, park the car and apply the brakes gently. You should be able to feel a slight "bump" when the pedal has been pushed down about an inch.

If the car is equipped with power brakes, you will not feel a "bump" when you push the brake pedal, so have an assistant push on the brake pedal with the engine running while you watch the valve stem. The valve stem should move as the brakes are applied. The rod should move into the valve as the brakes are applied, and move out of the valve as the brakes are released. On models prior to 1970, the rod action is just the opposite.

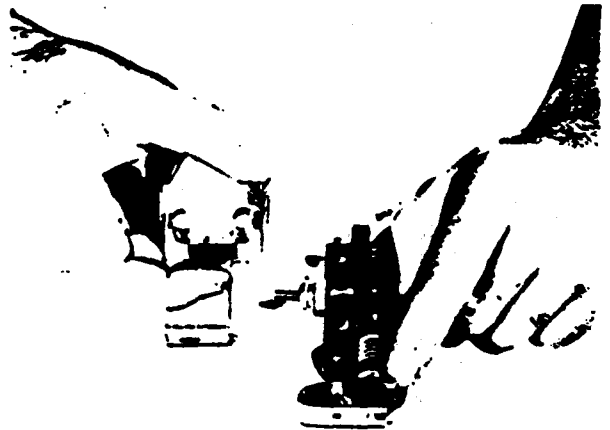


Fig. 11—Holding metering valve open

BLEEDING WITH METERING VALVE

Gravity bleeding is preferred on disc brake systems. However, if you use a pressure bleeder on a system with a metering valve, the metering valve must be held open. Pressure bleeders are usually operated at about 30 p.s.i. and this pressure will close the metering valve and shut off flow to the front brakes.

On early model metering valves, the stem is held in while the system is bled with a pressure bleeder. On current models, you should use special tool number C-4121 to hold the valve stem open while pressure bleeding the brakes. When you're through pressure bleeding the brakes **BE SURE TO REMOVE THE TOOL**. If the tool is left in place, full system pressure will rupture the diaphragm inside the metering valve when the brakes are applied. This will result in the complete loss of the front brakes.



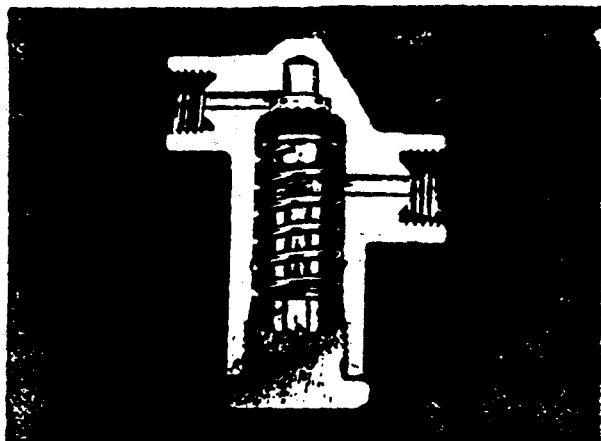


Fig. 12—Proportioning valve

PROPORTIONING VALVE

A proportioning valve is used on some models for the rear drum brakes when disc brakes are used in the front. During hard stops, the front disc brakes require more pressure. The additional pressure required would cause the rear drum brakes to lock. To eliminate this possibility, the proportioning valve is connected between the master cylinder and the rear wheel cylinder. The proportioning valve is designed to reduce the pressure to the rear wheel cylinders.

If the proportioning valve is not functioning properly, two things can happen — the valve will fail to proportion the hydraulic pressure to the rear brakes and they will apply prematurely; or, the valve will block off the flow of hydraulic fluid to the rear wheel cylinders. If the flow is blocked to the rear wheel cylinders, the front brakes will have to do all the work.

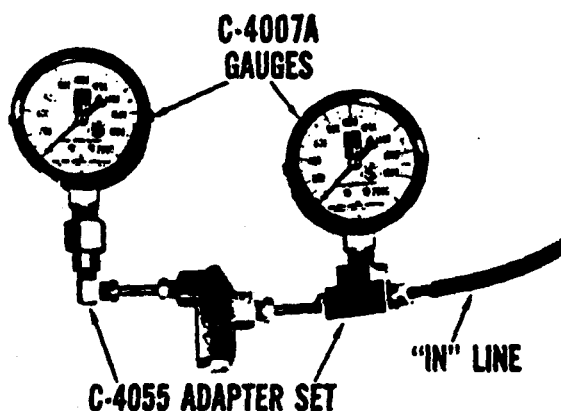


Fig. 13—Proportioning valve test

TESTING THE PROPORTIONING VALVE

To test the proportioning valve, you will need two pressure gauges (Tool C-4007A) and an adapter set (Tool C-4055). Install one of the gauges between the master cylinder and the proportioning valve. Install the other gauge in the output end of the valve. Have someone push hard enough on the brake pedal to build up 500 p.s.i. in the master cylinder (it will register on the gauge between the master cylinder and the proportioning valve). The gauge at the output end of the valve should register between 350 and 400 p.s.i.

Naturally, if the pressure reading does not meet specifications, remove the valve and install a new one. Remember, if you remove anything from the brake system — even a brake line — you have to bleed the system after you replace what was removed.

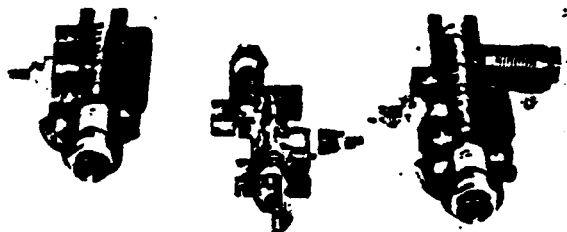


Fig. 14—Combination valves

COMBINATION VALVES

You have probably noticed during the course of your work that some cars combine the safety switch, metering and proportioning valves. Many of these combinations look alike, but don't settle for look-alikes. Check the part number before you replace combination valves.

For example: the combination valves used on intermediate-size cars and full-size cars look similar but the proportioning valve in the intermediate combination valve is designed for 500 p.s.i. inlet pressure and 360 to 405 p.s.i. outlet pressure, while the proportioning valve for the full-size models is designed for 700 p.s.i. inlet pressure and 550 to 610 p.s.i. outlet pressure. You can imagine what would happen if you installed the wrong one.



Getting into the habit of making a quick preliminary check of brake components before you begin a brake system overhaul can save you a lot of time in the long run, if you know what to look for.

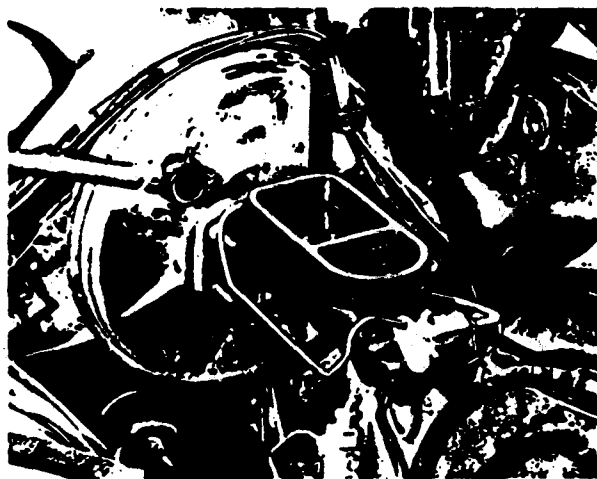


Fig. 15—Low fluid level

CHECK THE MASTER CYLINDER

A glance inside the master cylinder can give you an inside track to problems in other parts of the system. Low fluid in both reservoirs can indicate an internal leak, which of course would mean it is time for a master cylinder overhaul.

If the fluid is low in the primary side of a disc brake master cylinder it may not mean there is a leak in the system. As lining pads wear thin, the pistons move out farther in the cylinder bores ... so, it takes more fluid to keep the cylinders full.

Incidentally, if the primary side of the disc brake master cylinder is full before you begin replacing lining pads, remove some of the fluid or it will overflow when you push the pistons into their bores to provide clearance for the new, thicker linings.

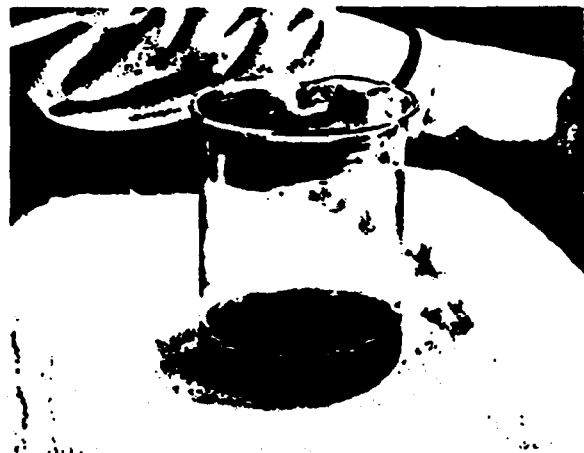


Fig. 16—Brake fluid contamination

CHECK FOR CONTAMINATION

It is a good idea to check the brake fluid for contamination before you begin an overhaul. Draw off some fluid and put it into a clean glass jar. If there is a separation of the fluid in the jar, the fluid has oil mixed with it. Flush the system completely and replace all rubber parts.

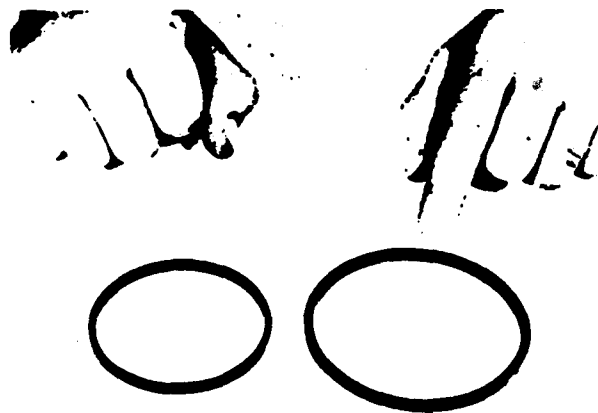


Fig. 17—Oil causes rubber parts to swell



Oil mixed with brake fluid can cause rubber brake system parts to swell and distort. If you would like to conduct a little experiment of your own, put an old seal into a pan of oil for a few days and watch what happens to it.

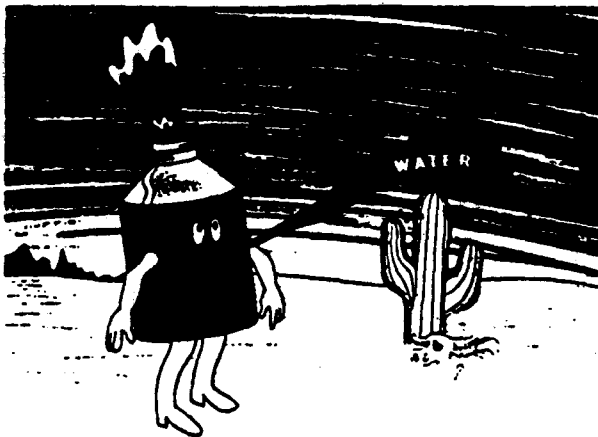


Fig. 18—Brake fluid absorbs water

WATER CONTAMINATES BRAKE FLUID

Brake fluid absorbs water like mad, right out of the air. Water lowers the boiling point and can cause serious problems. Vapor pockets can form in the brake system at relatively low operating temperatures. And because this vapor is compressible, it can cause loss of system operating pressure.

It's a good shop practice to keep all brake fluid containers closed airtight when they're not in use on a job. And remember to wipe the dispensing spout and the top of the container clean before you pour out fluid so you won't pick up dirt in the fluid.

HELPFUL INFORMATION

It is important for the write-up man to note on the Repair Order if the customer has been having any unique problems such as — grabbing brakes, chatter, etc., so you can use the information as a guide to problem solving.

For example, brake chatter can be caused by overheated areas or hard spots on the drum surface which causes uneven friction. Irregular, oval or heat-spotted brake drums can usually be machined to restore the friction surface to specification standards.

Incidentally, grinding drums with heat spots is better than machining because a tool bit tends to

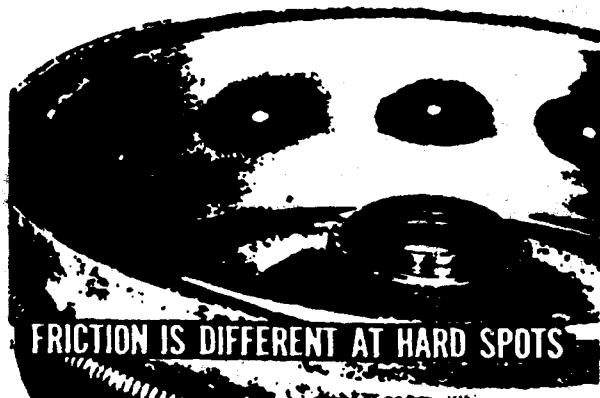


Fig. 19—Hard spots on drum surface

skip across the hardened areas. If you do use a drum lathe to refinish drums, make sure the cutting tool is sharp and set to make a smooth cut. When you're through machining the drum, don't forget to break up any machining pattern with sandpaper or emery cloth.

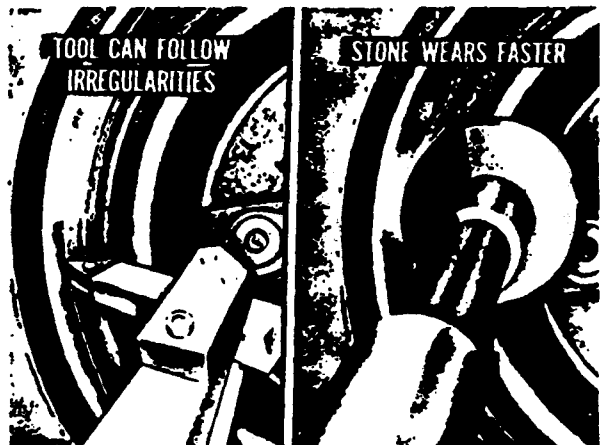


Fig. 20—Problems of overfeeding

By the way, if you're in a hurry and you think that you can get the job done faster if you take a deeper cut with the cutting tool or with the grinding wheel, you're going to get yourself into a lot of trouble. If you try a heavy cut, the cutting tool will follow the original surface irregularities like a phonograph needle, and duplicate the same condition you were trying to correct. So don't overfeed, okay?

Remember, take off only as much material from the drum surface as needed to clean up the irregularity. Never enlarge the brake drum diameter more



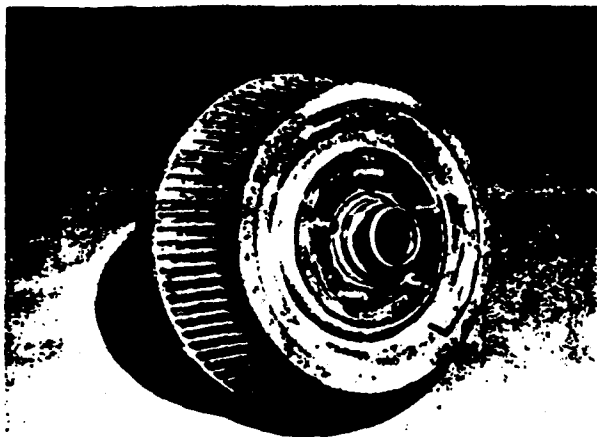


Fig. 21—Maximum diameter marked on drum

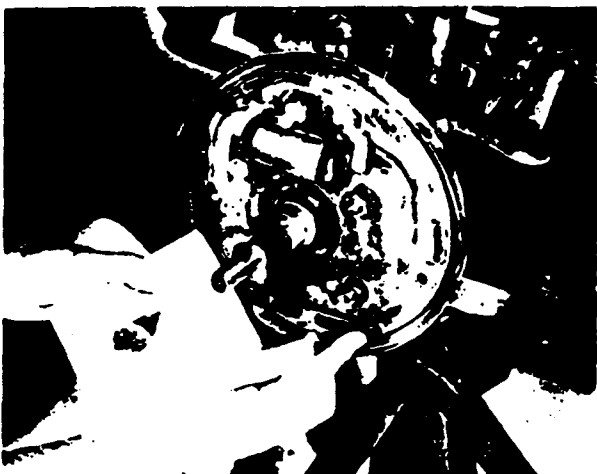


Fig. 22—Lube support plate



Fig. 23—Use recommended lubricant

than sixty-thousandths of an inch over the standard size. All drums since 1972 will show markings indicating the maximum diameter of the drum. For instance, a nine-inch drum will have a marking of maximum diameter — 9.090. This marking includes .030" for allowable drum wear beyond the recommended .060 drum refacing.

A word of caution . . . don't use an air hose to clean drums or the support plates. The asbestos in the lining material can irritate your lungs if you breathe it.

CHIRPING BRAKES

You can eliminate some complaints of chirping brakes by putting platform lube on the support plate contact areas. Be sure to use recommended lubricant — MOPAR 2932524 or equivalent — it has high-temperature stability and doesn't wash off.

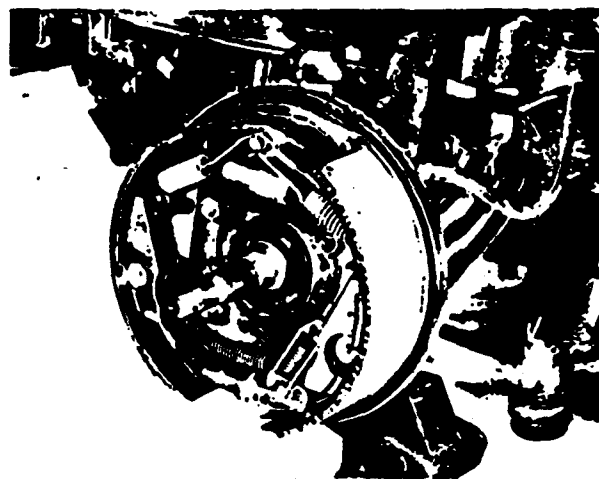


Fig. 24—Weights on front shoes

NOISY 9" DRUM BRAKES

There have been some complaints that nine-inch brakes are noisy. The fix for this complaint is a set of weights which bolt to the front brake shoes of 1970 through 1972 and 1973 early production Valiants and Darts equipped with 6-cylinder engines and 9" drum brakes. The repair kit is called a "WEIGHT PACKAGE" and is Part Number 3744494. The weights are to be installed on the front brake shoes only . . . DO NOT INSTALL THE WEIGHTS ON REAR BRAKES.

Due to an oversight, some of the weight packages were shipped without an instruction sheet. If you run across one of these kits without instructions, breathe easy . . . here's how to do the job:



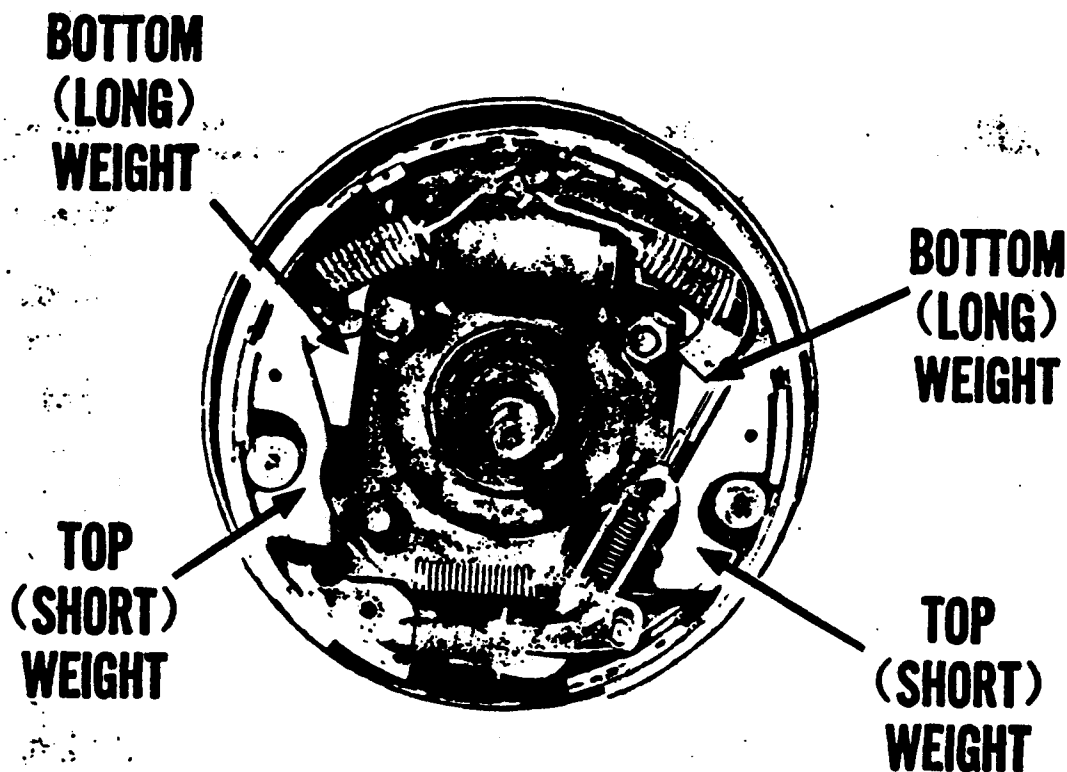


Fig. 25—Installing weights

The following instructions for installation of this shoe weight service package apply to *front brake shoes only*. Do not install this package on rear brakes. Any abnormal conditions such as badly worn linings, scored drums, fluid leakage, grease contamination and/or indications of component malfunction must be corrected before installing this package.

1. Place vehicle on hoist or raise front end of vehicle.
2. Remove front wheels and brake drums. Do not remove brake shoes from support plates.
3. Place one of the bottom (or longer) shoe weights against the secondary shoe web so that the cut-out area of the weight surrounds the shoe hold-down spring with *equal clearance* and the curved portion of the shoe weight is snug against the shoe table. The thinner pointed end of the shoe weight must be toward the shoe top, or anchor end. Make sure that there is adequate clearance between the weight and the adjuster cable assembly.
4. While holding the shoe weight in position, mark the shoe web through the hole in the weight with a 9/32" drill bit.
5. Repeat steps 3 and 4 for the primary shoes.
6. Remove the primary and secondary shoes from the brake assembly. Use care in handling the brake shoes so that no grease gets onto the rubbing surface of the linings.
7. Use a "C" clamp or "Vise-Grip" type of locking pliers to hold the smaller weight at the location marked in step 4. The weight bolt hole will serve as a drill guide to avoid hole wander while drilling.
8. Drill one 9/32" diameter hole through each shoe web at the location marked. *Remove any burrs and chips from the shoe webs with a file.*
9. Place the top (or shorter) shoe weight outboard and the bottom (or longer) shoe weight inboard on the primary and secondary shoe



webs as shown. Attach with the screw and washer assemblies provided. Make sure that the screw head is on the inboard (support plate) side of the shoe assembly. Tighten to 90 plus or minus 5 inch-pounds torque.

10. Before reassembling shoes to the brake, apply a thin film of support plate lubricant (Part Number 2932524 — not included in package) to the shoe tab contact areas. Reinstall shoes onto brake assembly. Make sure that no interference exists between the weights and adjuster cable assemblies.
11. Install brake drum, wheel assembly, bearings, thrust washer and nuts. **NOTE:** Make sure that bearings have adequate lubricant.
12. Tighten wheel bearing nuts to 300 inch-pounds torque with wheel rotating. Back off the nut and retighten to a fingertight condition. Position nut lock on nut with one pair of slots in line with cotter pin hole and install cotter pin and grease cap.
13. Check brake adjustment.
14. Check brakes for proper operation.

DISC BRAKE SQUEAL AT LOW SPEEDS

Brake noise described as high-pitch squeal that occurs on light brake application at speeds generally below 40 MPH, may be caused by the pad and lining assemblies vibrating.

The vibrating is the result of metal-to-metal contact between the back plate of the outboard shoe and the caliper fingers and between the back plate of the inboard shoe and the piston face. Of course, any abnormal conditions, such as badly worn lining, scored rotors, worn pins or bushings, and corroded pistons can also cause noise and should be corrected before you begin work.

Remove the guide pins (and positioners if the car is a 1972 or prior model) to dismount the caliper. Carefully slide the caliper out and away from the disc and adapter.

Inspect the bond of the outboard shoe to the machined caliper fingers. If the shoe is not firmly bonded to the caliper, it must be re-cemented. Remove the old cement from the shoe back and caliper fingers with a rag dampened in lacquer thinner.

WARNING: DO NOT ALLOW LACQUER THINNER TO CONTACT THE SHOE LINING OR RUBBER PISTON BOOT.

Re-apply a liberal coating of Cycleweld K101 Cement (Chrysler Part Number 3683897) to both surfaces. Allow the cement to air-dry for approximately fifteen minutes or until the surface texture appears dull.

Next, clean the back of the inboard pad with medium-grit sandpaper, emery paper, or a wire brush.



Fig. 26—Apply Cycleweld Cement to piston face

Work with care so you don't contaminate the lining surface. Wipe off the piston surface and the inboard shoe back with a clean, dry cloth. Apply a coating of Cycleweld cement to the clean inboard shoe back, and a thin coat to the flat piston surface which contacts the shoe back. Allow the cement to dry for fifteen minutes.

To align the cemented shoe assemblies in the caliper, temporarily install the guide pins and bushings with the linings face to face in the center of the caliper. Slide the shoes along the pins until contact is made with the coated caliper fingers and piston surface. Press each shoe firmly in place to make a good bond. Remove the guide pins. Slowly and carefully push the piston back into the caliper bore until it is bottomed.

Next, slide the caliper down into position in the adapter and over the disc. Align the pin holes in the caliper, adapter, inboard and outboard shoes. Reinstall the caliper guide pins (and positioners if so equipped). Tighten the guide pins from 30-35 foot-pounds torque.

TEST QUESTIONS

1. A residual valve is never used in the primary master cylinder used for disc brakes.
 - A. The residual valve is built into the caliper assembly. *True* *False*
 - B. The residual valve is built into the combination valve. *True* *False*
 - C. Residual pressure in the primary system would prevent the seal around the piston from retracting the disc brake pad and cause the brakes to drag. *True* *False*
2. Some truck master cylinders used for disc brakes are different.
 - A. They have transparent covers so you can check the level of the fluid without removing reservoir cover. *True* *False*
 - B. The smaller reservoir which supplies fluid to the rear drum wheel cylinders is in the primary position and the larger reservoir which supplies pressure to the front disc brakes is in the secondary position. *True* *False*
 - C. The warning light is built into the master cylinder. *True* *False*
3. Tool C-4121 must be removed from the metering valve when you're through pressure-bleeding disc brakes.
 - A. If the tool is left in place, full system pressure will rupture the diaphragm inside the metering valve when the brakes are applied. *True* *False*
 - B. The tool holds the valve stem closed so the tool will short-circuit the warning light. *True* *False*
4. The proportioning valve is usually connected between the master cylinder and the front disc brakes.
 - A. *True* *False*
5. Oil mixed with brake fluid can cause rubber brake system parts to swell and distort.
 - A. *True* *False*
6. Brake fluid absorbs water, which in turn raises the boiling point of the fluid.
 - A. *True* *False*
7. Never use an air hose to clean drums or the support plates because the asbestos in the lining material can irritate your lungs if you breathe it.
 - A. *True* *False*
8. Some complaints of chirping drum brakes can be eliminated by putting a platform lube with high-temperature stability on the support plate contact areas.
 - A. *True* *False*
9. The "WEIGHT PACKAGE" used for nine-inch drum brakes should only be installed on the front shoes.
 - A. *True* *False*
10. Brake noise described as high-pitch squeal that occurs on light brake application at speeds generally below 40 MPH is usually caused by low brake fluid in the primary side of the master cylinder.
 - A. *True* *False*



**MASTER
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MASTER TECHNICIANS SERVICE CONFERENCE

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70-9

BRAKE HYDRAULICS

STOP



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With the advent of today's modern freeways, a lot of people are doing a considerable amount of high-speed driving in their everyday lives. Most of the time traffic moves along at a pretty steady pace. Of course, during rush hour – and for that matter, at any time – freeway driving can become bumper-to-bumper, stop-and-go within seconds. What I'm trying to say is that on the freeways, "whoa" power is just as important as "go" power. It's even more important for those emergency situations that require extremely heavy braking.

The brakes are one of the most important safety devices on any vehicle. And, if the brakes are working right, the driver can count on a safe, sure stop every time. He relies on his brakes for his own safety and the safety of others. This month's session covers the complete "how it works" story on the latest Chrysler brake hydraulic systems – both drum and disc. If you understand the fundamentals, it's easier to follow the diagnosis and service tips that are included in this reference book.

Since our last session on the brake hydraulic system, there have been some changes and improvements made to both the drum and disc brake systems. There's nothing overly complicated about these changes and you won't have any trouble understanding them if you take the time to read this reference book carefully and thoroughly.



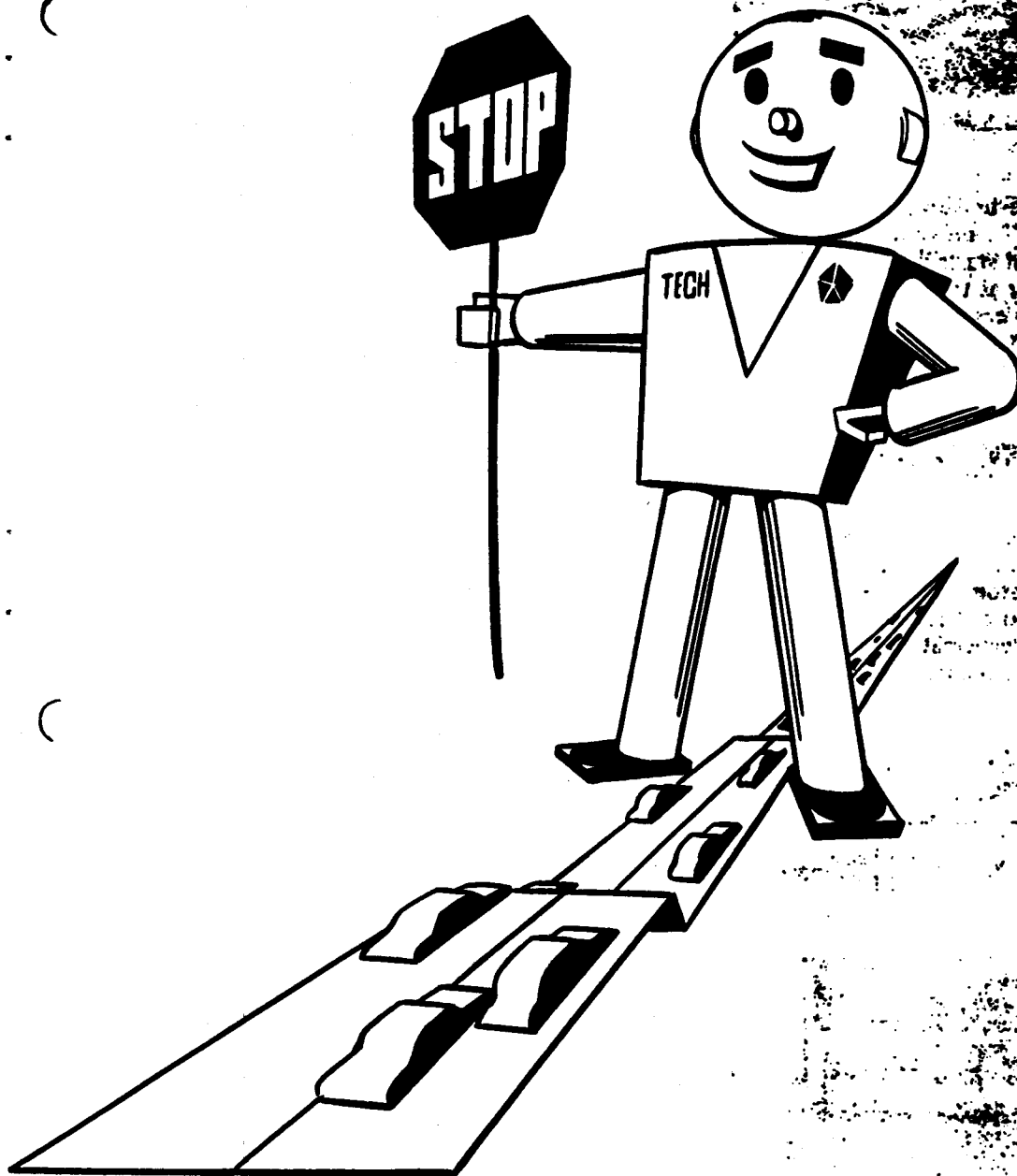
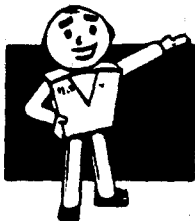


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MASTER CYLINDER

Although the drum and disc brake systems have different devices to control the pressure to either the front or rear brakes, it all starts at the master cylinder. The master cylinder is the supply house for the hydraulic fluid. It is designed to separate the hydraulic systems for the front and rear brakes, to insure that loss of pressure in one system won't result in loss of pressure in the other.

TWO 'N' ONE EQUALS ONE

The tandem master cylinder has two separate fluid reservoirs arranged one behind the other in one housing and two separate pistons that operate in tandem in a single cylinder bore. The piston at the front of the master cylinder creates hydraulic pressure to the rear brakes and the rear piston does the same for the front brakes.

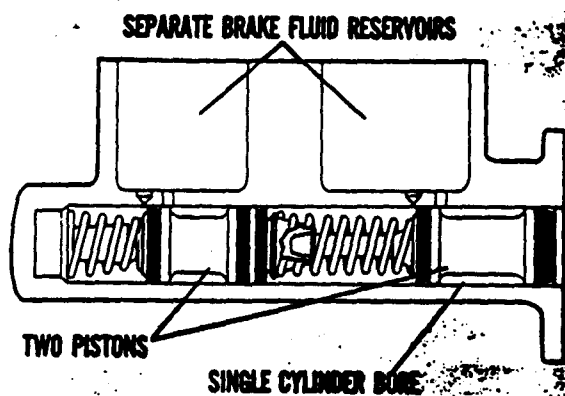


Fig. 1—"Tandem" means one behind the other

PRIMARY AND SECONDARY

It's easier to keep things straight if you think of the rear piston as the *primary* piston since it is actuated directly by the brake pedal or the power booster. In addition, the primary piston supplies hydraulic pressure to the front brakes where most

of the braking power is needed. It stands to reason that the front piston is the *secondary* piston and supplies pressure to the rear brakes. Whereas the primary piston is operated *mechanically* the secondary piston is operated *hydraulically* by pressure from the primary piston. So actually, the secondary piston is a *slave* piston.

NO CHANCE OF A GOOF

If you have any trouble remembering which is which, the brake line fitting nuts at the front and rear outlets are different sizes. This eliminates the possibility of connecting a brake line to the wrong outlet. The outlets are also marked "F" and "R" to designate which set of brakes it serves. You can't get much more "goof-proof" than that.

RETURN SPRINGS

Here's what happens inside the master cylinder. Each piston has a return spring ahead of it to position the piston cup slightly to the rear of the compensating port in each reservoir. In addition to keeping the compensating ports uncovered, the return springs also return the brake pedal. The compensating ports will be covered in detail later along with the filler ports.

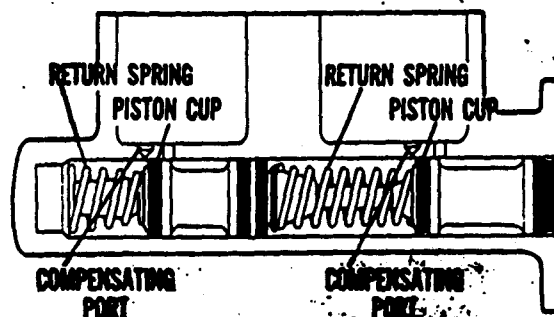


Fig. 2—Springs return piston and brake pedal



HOW MASTER CYLINDER BUILDS PRESSURE

When the brakes are applied, the stiffer primary spring pushes the secondary piston forward, compressing the secondary spring slightly. The cup at the front end of the secondary piston passes and closes off the secondary compensating port. Pressure in the secondary portion or chamber starts to build up. At the same time, the piston cup on the primary piston has closed off the primary compensating port. Since fluid is now trapped in front of each piston, further pedal movement builds pressure in both the primary and secondary.

HYDRAULIC LINK BETWEEN PISTONS

During normal operation, there is a hydraulic link between the primary and secondary pistons. As I mentioned before, the secondary piston is actually a slave piston operated by pressure developed in the primary chamber. The piston cup at the rear of the secondary piston works as the "closed end" of the primary chamber; and as long as the secondary piston is free to move forward, you can't build any more pressure in the primary than in the secondary chamber. As a result, operating pressures in both chambers are equal and front and rear brakes are applied equally.

WELL ... ALMOST EQUAL

Actually, hydraulic pressure is proportional to the force applied to the push rod by the brake pedal ... minus the resistance offered by the return springs. The primary return spring is slightly stiffer than the secondary spring and holds the primary piston back a little more than the secondary piston. Therefore, the secondary pressure is slightly higher than the primary pressure; however, compared to the total hydraulic pressure developed, the difference is very small.

DISC AND DRUM MASTER CYLINDERS

The disc brake master cylinder is different from the drum brake master cylinder and they cannot be interchanged. They are quite obviously different from a physical appearance standpoint; however, there are different models among both the drum and disc master cylinders. A chart at the end of this reference book lists the application, part number and identifying features for all 1970 master cylinders. The following paragraphs explain

in what ways the disc brake master cylinders are different from the drum brake master cylinders.

LARGER RESERVOIRS

The disc brake master cylinders have larger reservoirs. There really isn't any reason for the secondary reservoir to be larger, but the primary is a different story. The primary reservoir for the disc brakes is bigger because the disc brake pistons in the calipers are larger than the drum brake wheel cylinder pistons so that more fluid is required as the disc brake lining wears away. Naturally, the larger disc brake pistons require more fluid to move them and this greater amount of fluid is supplied by the disc brake master cylinder.

ONLY ONE RESIDUAL VALVE FOR DISCS

The other difference in the disc brake master cylinders is that there is only one residual valve; and that valve *must* be in the secondary outlet at the front of the master cylinder. That's the one for the rear drum brakes. Residual pressure in the primary brake lines would make the disc brake shoes drag and wear out prematurely. That's because there are no brake shoe return springs with disc brakes; the piston seals act as retractors to pull the pistons back.

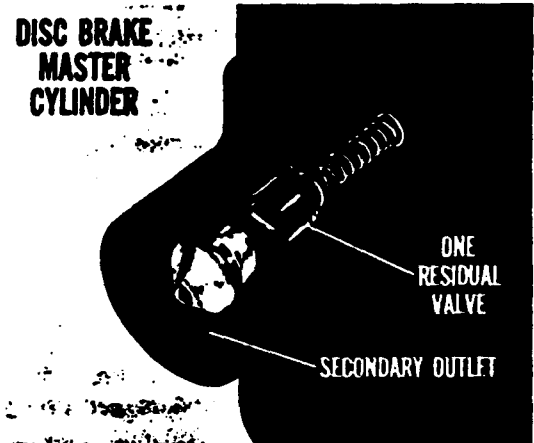


Fig. 3—Residual pressure would make disc brakes drag

WHY RESIDUAL VALVES

The residual pressure valves are located in the master cylinder outlets. They maintain a light pressure in the lines and in the wheel cylinders. If it were not for these valves, air might be sucked past the wheel cylinder cups and enter the wheel



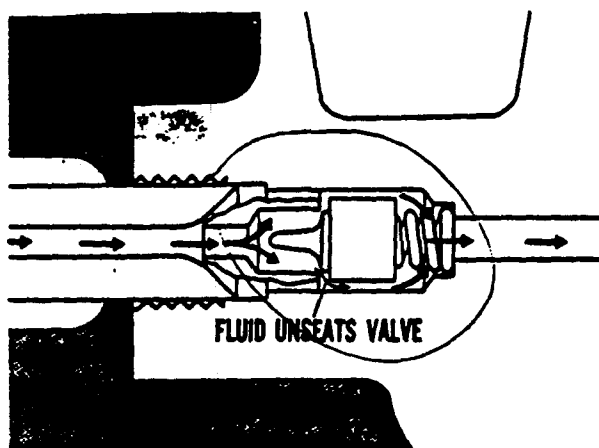


Fig. 4—Valve seats at 15 p.s.i. to maintain pressure
NOT USED AFTER 1971 MY

cylinder when the brake pedal is released rapidly. When the brakes are released, fluid flows out of the wheel cylinders and back to the master cylinder. This unseats the residual pressure valve which allows fluid to flow into the master cylinder. When fluid pressure drops to about fifteen pounds, the valve is seated and residual pressure is maintained. Residual pressure keeps the lips of the wheel cylinder cups expanded so that they press outward against the wheel cylinder bore.

PORTS—COMPENSATING AND FILLER

Light residual pressure is necessary for drum brakes, however, repeated brake application can cause too much pressure. The compensating ports eliminate this problem. The residual pressure also contributes to the action that permits pedal pump-up, but, primarily that is the job of the filler ports. Let's examine in detail how each does its job.

HEAVY BRAKING CAUSES FLUID EXPANSION

After numerous brake applications, the brake drums and the wheel cylinders get pretty hot. Then, the brake fluid gets hot and expands. The pressure buildup can become great enough to prevent the brake shoes from returning. This causes the brake-shoes to drag and generate *more* heat and more pressure.

COMPENSATING PORTS DO JUST THAT

The compensating ports are small passages between the reservoirs and the cylinder bore. What they do

is allow pressure to compensate or equalize when the pistons are fully returned.

When pumping the brakes, more than the normal amount of fluid is forced into the hydraulic system and builds up pressure. When the brake pedal is released, the piston moves back far enough to uncover the compensating ports and the fluid can flow back into the reservoir and relieve the excess pressure in the lines and wheel cylinders. After the system cools and contracts, fluid can flow back into the cylinder to maintain full volume for the next application. Any air bubbles in the cylinder will also be able to bleed into the reservoir.

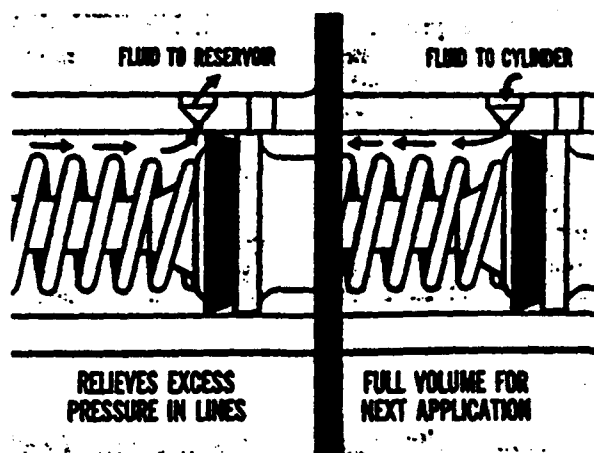


Fig. 5—Compensating ports prevent brake drag

FILLER PORTS ARE FOR PEDAL PUMP-UP

A low brake pedal is almost always due to excessive lining clearance, and that can happen through normal wear when the automatic brake adjusters aren't doing their job. However, a low pedal can also be a result of air in the brake system, low fluid level, disc brake shoes that are not flat, or severely under-ground.

The filler ports permit pumping up of the brakes if the pedal is low. If the brake pedal is pumped rapidly, the return springs in the master cylinder return the pistons quickly. At the other end, the brake shoe return springs return the wheel cylinder pistons a lot slower. The flow of fluid from the wheel cylinders is delayed and can't match the fast return of the master cylinder pistons. As a result, the master cylinder pressure drops and becomes lower than the pressure in the reservoir. Fluid is



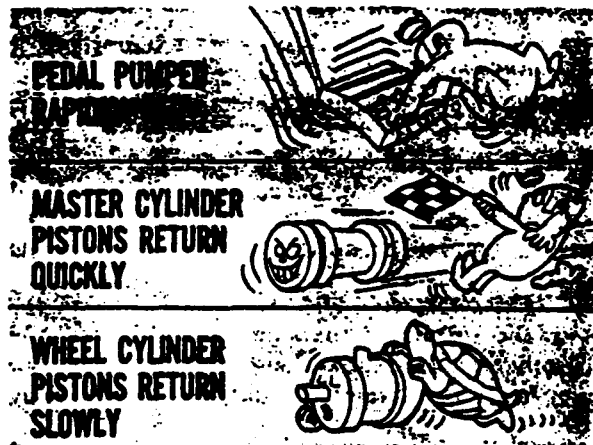


Fig. 6—Fluid flow is delayed at wheel cylinders

forced out of the reservoir by atmospheric pressure through the filler ports, through the holes in the piston, and past the piston cup. These filler ports are necessary because the compensating ports aren't big enough to handle the flow needed to pump up the pedal.

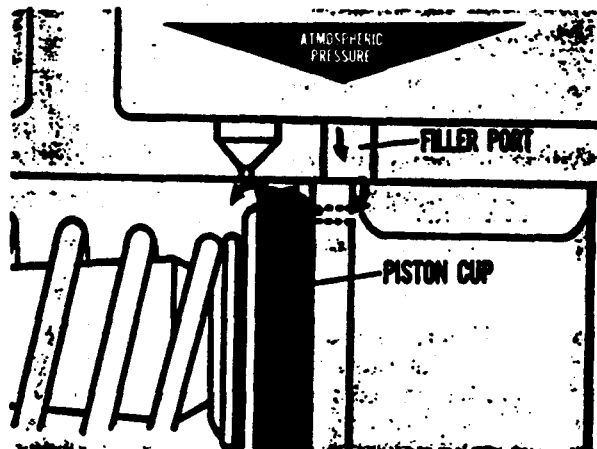


Fig. 7—Filler ports provide fluid to pump up pedal

PRESSURE LOSS IN HYDRAULIC SYSTEM

By now, you should have a pretty good idea of how the master cylinder works during normal operation. However, as mentioned earlier, the master cylinder is designed to separate the front and rear brake systems and insure that loss of pressure in one system won't result in loss of

pressure in the other system. The following paragraphs explain what happens when pressure is lost in either system.

FRONT BRAKE PRESSURE LOSS

If pressure is lost in the front brake hydraulic system, the hydraulic link is broken and there is very little pressure to resist primary piston movement. The primary piston will move forward until it bottoms against the secondary piston. Then the secondary piston is operated mechanically by the primary piston to apply the rear brakes.

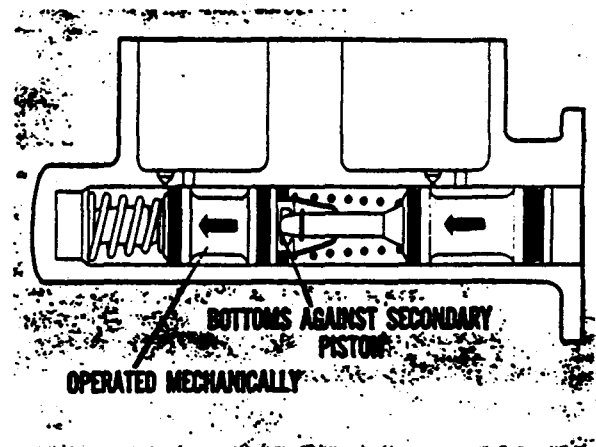


Fig. 8—Hydraulic link is broken

REAR BRAKE PRESSURE LOSS

When pressure is lost in the rear brake system, hydraulic pressure in the primary chamber, plus

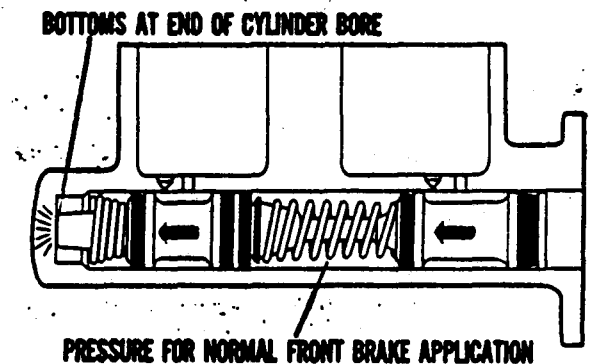


Fig. 9—When secondary bottoms, primary goes to work

spring force, pushes the secondary piston until it bottoms at the end of the cylinder bore. At that point, the primary piston begins to supply pressure for normal brake application.

COVER AND GASKET

Now that the internal parts of the master cylinder have been discussed, let's talk about the master cylinder cover and cover gasket. They are important because they provide an airtight seal while allowing the system to "breathe".

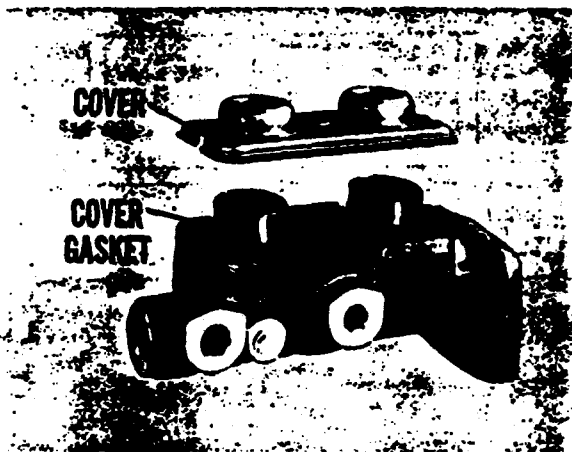


Fig. 10—Cover gasket must keep moisture out

GASKET HAS TWO JOBS

The master cylinder cover gasket's main job is to provide an airtight hydraulic system. Of course, the

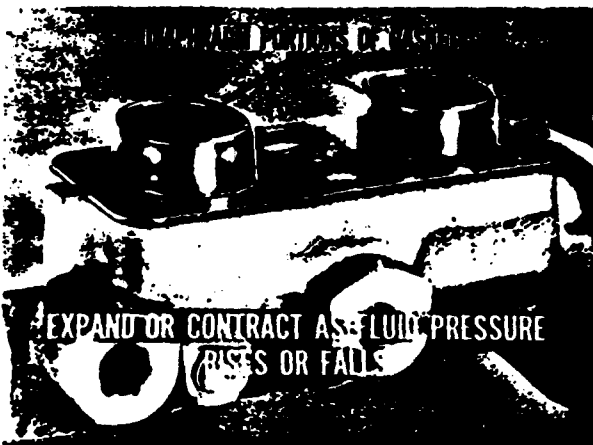


Fig. 11—Cover gasket also acts as a diaphragm

cover gasket prevents foreign matter from getting into the hydraulic fluid; but, most important, it *must* prevent moisture from entering the system. Moisture in any hydraulic system breaks down the lubricity of the fluid and causes corrosion of parts in the system. The cover gasket also acts as a diaphragm and expands or contracts as the fluid pressure rises or falls. In severe stopping, the demand for fluid could create a vacuum below the diaphragm which would prevent fluid from flowing out of the reservoir and could pull air into the hydraulic system at the wheel cylinder seals. On the other hand, if the gasket could not expand, air trapped above the reservoir could be pressurized by heat expansion and possibly cause brakes to drag.

COVER HELPS GASKET

For the gasket to be able to expand and contract, the space between the gasket and the cover must be vented. Small vent grooves or drilled holes, built into the master cylinder cover, vent the space between the cover gasket and the cover. It is just as important for these vents to let air in as it is to let it out.

DIAGNOSIS AND SERVICE

Thus far, the master cylinder has been covered in detail as to how it works to supply and properly maintain hydraulic pressure to the brakes. The next thing that will be covered is how to make sure the master cylinder is working properly.

QUICK AND EASY WAY TO TEST MASTER CYLINDER

Pedal feel is still the quickest and easiest way to test the master cylinder. There are two conditions to look for — a spongy pedal, and one that feels firm but sinks slowly to the floor. A spongy pedal usually indicates a brake system that needs bleeding, but first check the master cylinder to make sure the fluid level is high enough. A firm pedal that gradually goes to the floor usually means that the master cylinder piston seals are bad and the master cylinder should be replaced or overhauled.

INSPECT HOSES AND FITTINGS

Before you replace or overhaul the master cylinder, check the brake hoses and fittings carefully. You could be losing pressure at a loose or damaged fit-



Fig. 12—There are two conditions to look for

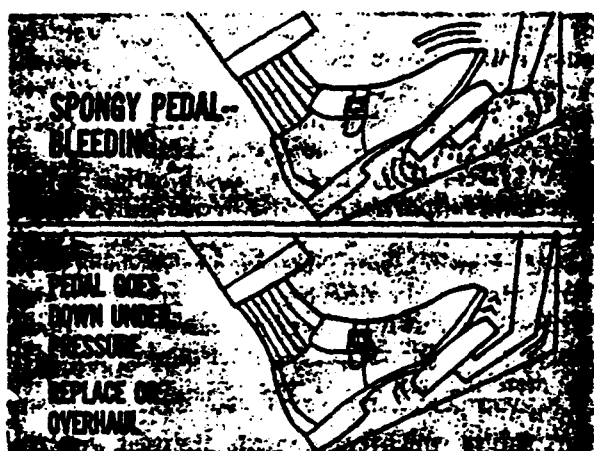


Fig. 13—Check fluid level and fittings after testing

ting or through a pinhole or fine crack in the hose or tube. Hoses which have the rubber cover perforated by nicks, cracks or abrasions should be replaced. Tubes should be checked for deformation and closeness to moving or hot parts and corrected if necessary. Any brake tubing that is replaced must be replaced with steel tubing; copper tubing is not recommended for brake line installations. Actually, it is a good practice to inspect the brake lines and fittings any time you put the car up on a lift or hoist.

USE MANUALS AND BENCH-BLEED

If you have to overhaul or replace the master cylinder, the Service Manuals are the best source for complete removal, disassembly, and installation

BLEED MASTER CYLINDER BEFORE INSTALLING

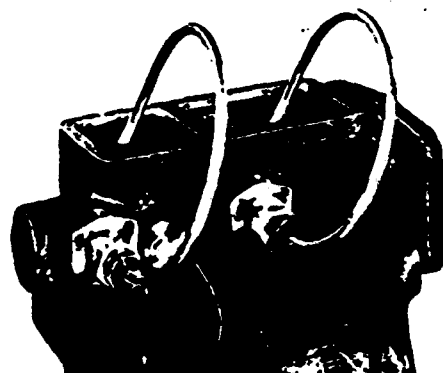


Fig. 14—Use bleeding tubes and follow Service Manual

procedures. The master cylinders for both drum and disc brakes are covered in detail. If you replace or overhaul the master cylinder, be sure to bench-bleed the master cylinder before installing it on the car. If there's air in the master cylinder, there's no point in pumping it through the whole system and out the bleeder screws. When bleeding out the brake lines, the bleed screws must be fully open. If you crack the bleed screw less than one full turn, an orifice is formed which compresses trapped air to form tiny bubbles. This condition is known as aeration and is very hard to eliminate, so be very careful to avoid causing this condition. Be extremely careful to keep the fluid level up in both reservoirs when bleeding. If it gets low, you'll pump air into the hydraulic system and have to start all over again.

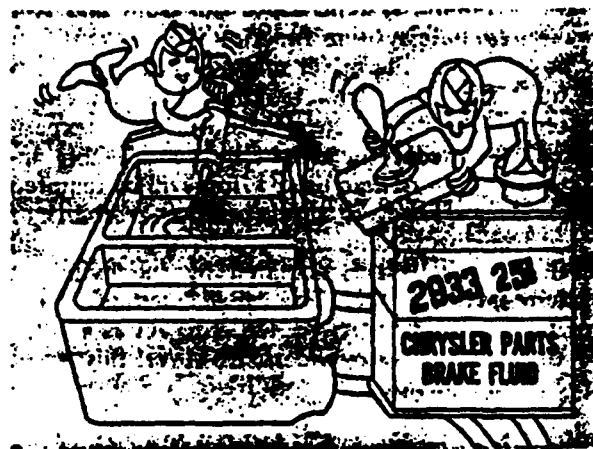


Fig. 15—Not worth the risk to use unknown fluids

USE PROPER FLUID

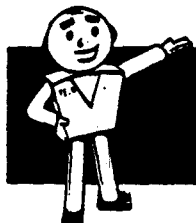
And be sure to use Chrysler Parts brake fluid. It has the high boiling point required for safe brake operation and is compatible with rubber parts. It's dangerous to risk using unknown fluids that might not meet specifications.

MASTER CYLINDER CHART

Before we leave the subject of master cylinders,

here's a final pointer. When you replace a master cylinder, always check the part number to make sure you're installing the right one. Some master cylinders look alike on the outside, but have different front and rear displacements.

There is a handy chart on the last page which gives the correct part numbers and identifying features for all current brake system applications.



HYDRAULIC BRAKE SYSTEM CONTROLS

Once the master cylinder supplies hydraulic pressure to the brake system, the drum and disc brake systems use different components to regulate pressure or distribute fluid to the front and rear brakes. These components are known as the hydraulic system safety switch, the proportioning valve, and the metering valve. The hydraulic system safety switch is the one of the three that is used on all systems, so let's start with that one.

HYDRAULIC SYSTEM SAFETY SWITCH

The main purpose of the hydraulic system safety switch is to operate a warning light which tells the driver if pressure is lost in either the front or rear brake hydraulic system. Since the front and rear brake hydraulic systems function independently, it is possible that the driver might not notice immediately if pressure and braking is lost in either system. Actually, when a pressure loss is experienced, the pedal travel will be considerably increased and more than usual effort will be required for braking. However, to rule out the possibility of the driver disregarding this condition, the low fluid level warning light is actuated by the hydraulic system safety switch. The other function of the hydraulic system safety switch is to act as a "tee" to the front wheel cylinders. However, this is not true of all systems.

FIVE DIFFERENT SYSTEM APPLICATIONS

There are five different brake system applications

for the hydraulic system safety switch. First, the drum brake system uses only the safety switch. Second, the fixed caliper disc brakes use the safety switch with a proportioning valve behind it. Third, as of the first of January, the fixed caliper disc brake system uses the new combination safety switch and proportioning valve in one unit. Fourth, the floating caliper disc brake system which uses the safety switch with a metering valve ahead of it. Fifth, the floating disc brake system that uses all three — safety switch, metering valve, and proportioning valve. Of course, the later models will have the metering valve and the combination safety switch and proportioning valve. The accompanying chart shows which components are used with the various brake systems for the different body sizes.

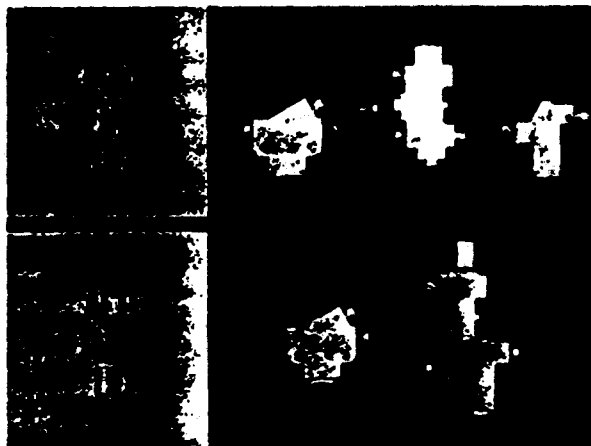


Fig. 16—Switch and proportioning valve combined



BRAKE SYSTEM COMPONENT CHART				
Model	Brake Type	Hydraulic System Safety Switch	Proportioning Valve	Metering Valve
Compact	Drum Disc	X *X	X	
Challenger & Barracuda	Drum Disc	X *X	X	X
Intermediates	Drum Disc	X *X	X	X
Full-Size	Drum Disc	X X		X

* Combination Safety Switch and Proportioning Valve after Jan. 1, 1970.

No Proportioning Valves on suburban models

INSIDE THE SAFETY SWITCH

A barbell-shaped, double-headed piston, with an "O" ring on each end, separates the front and rear brake hydraulic systems. Coil springs at both ends keep the piston centered as long as the pressure stays the same in both systems. If pressure is lost in either system, pressure from the other system pushes the piston off-center. When the piston moves far enough to touch the ground contact in the switch, the warning light ground circuit is completed and the light comes on. The springs in the hydraulic system safety switch are quite stiff so that minor variations in pressure will not cause the

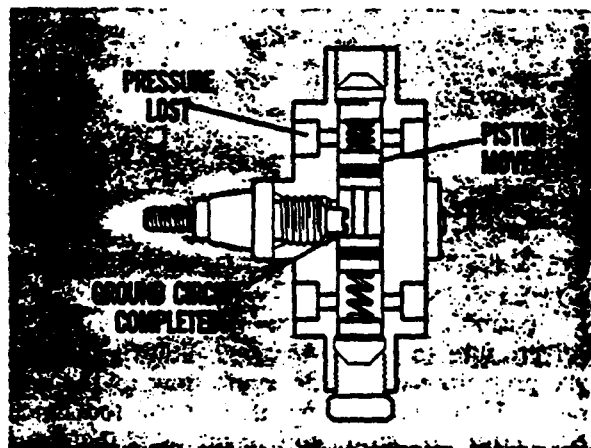


Fig. 17—Minor pressure variations won't move piston

piston to move far enough to touch the ground contact. For example, in a disc brake system, residual pressure in the secondary system will not cause the light to come on even though there is no counteracting residual pressure in the primary.

SAFETY SWITCH OUTLETS

The front brake part of the hydraulic system safety switch has an inlet and two outlets. As mentioned earlier, the safety switch functions as a "tee" to the front brakes in some applications. However, for systems using the metering valve, one of the outlets is plugged. You'll see why when the metering valve is discussed. The rear brake part has an inlet and only one outlet. Different size tube connectors are used here, the same as on the master cylinder, to prevent incorrect brake line connections.

FLOATING CALIPER DISC BRAKE APPLICATION

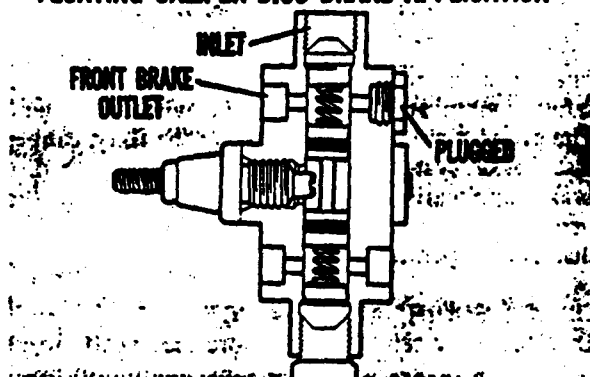


Fig. 18—In this case, switch doesn't act as a "tee"

TEST THE BULB, THEN THE SWITCH

It's pretty simple to test the hydraulic system safety switch; but *test the warning light bulb first*. Apply the parking brakes with the ignition on. One light does two jobs, so the bulb is "proofed" or tested every time the parking brake is applied with the ignition on. Then, have someone apply the service brakes and watch the warning light while you momentarily open a front, and then a rear, bleeder screw. If the light doesn't come on, install a new switch. There's one very important thing to remember if you have to install a new hydraulic system safety switch. Make sure you don't install one of the new ones with the integral proportioning valve if there wasn't one there in the first place. You'll see why when we discuss the proportioning valve in detail.

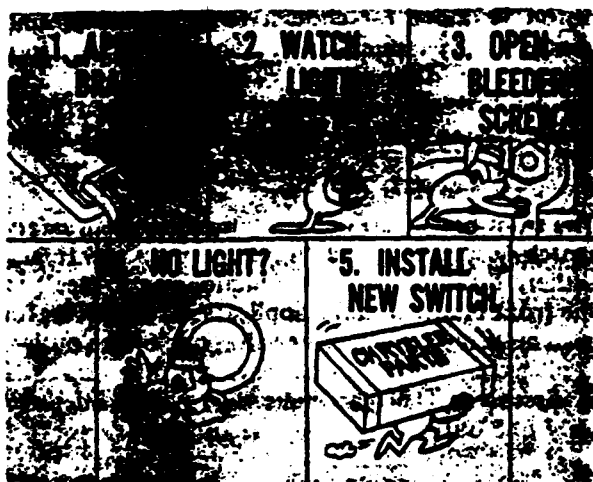


Fig. 19—Test warning light with parking brake, first

PROPORTIONING VALVE

The proportioning valve is located between the safety switch and the rear brake wheel cylinders. The proportioning valve is used on the fixed caliper disc brake system and some floating caliper disc brake applications. To properly understand the operation of the proportioning valve, let's review disc brake operation.

DISCS REQUIRE MORE FORCE

Disc brake systems require more brake-shoe force than drum brakes to get the same amount of braking action. The proportional area of the front and



Fig. 20—Tire traction reduced by weight shift

rear brake pistons is such that equal pressure front and rear will produce balanced braking on normal applications. However, in a hard stop, disc brake piston force must be quite high to get proper braking action. Because rear tire traction is reduced by a weight shift in a sudden stop, the rear brakes tend to lock up prematurely from a high-pressure application.

THE PROPORTIONING VALVE

On all fixed caliper systems and intermediate models with floating caliper systems, a proportioning valve operates when the hydraulic pressure reaches a certain point to retard or proportion the pressure build-up in the rear brake lines and wheel cylinders. On light pedal applications, the valve simply lets brake fluid flow through it to the rear brakes. On hard brake applications, system pressure naturally climbs higher. Above three-hundred p.s.i., a spring-loaded sliding piston in the valve moves against the spring pressure to proportion rear system pressure to about fifty percent of the pressure to the front brakes. This way the valve provides a pressure difference to keep front and rear braking forces in balance.

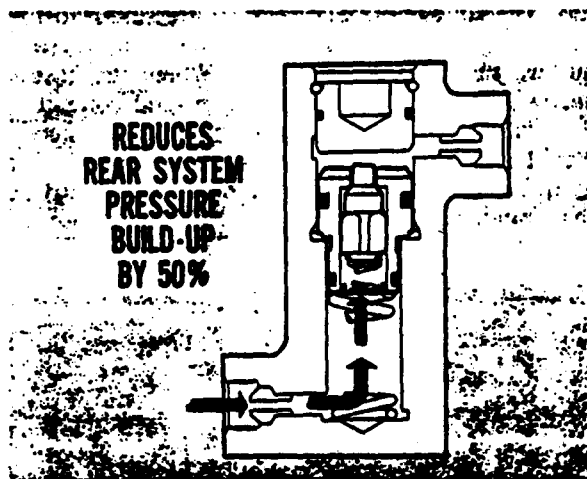


Fig. 21—Pressure is reduced above 300 p.s.i.

IF THE PROPORTIONING VALVE IS BAD . . .

. . . it can do one of two things — fail to proportion pressure to the rear brakes, allowing them to lock prematurely; or, block off flow to the rear brakes. If the latter happens, you use too much pedal effort to stop, you might lock the front brakes.



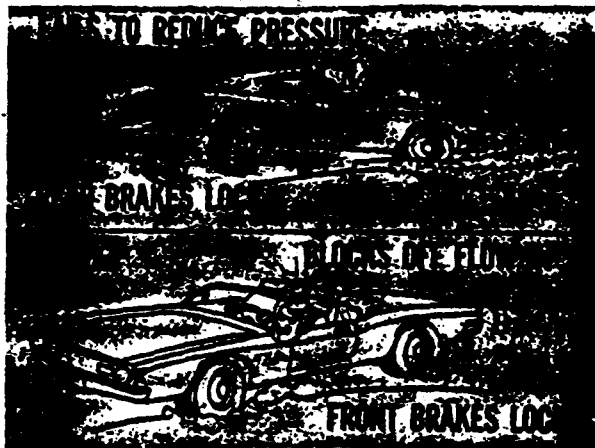


Fig. 22—These are results of bad proportioning valve

YOU'LL NEED GAUGES TO TEST THIS ONE

To test the proportioning valve, install a pressure gauge (Tool C-4007) in the brake line between the master cylinder and the proportioning valve. Install the other gauge at the output end of the valve. Have someone push on the brake pedal hard enough to get a master cylinder output of approximately 500 p.s.i. While holding 500 p.s.i. master cylinder pressure the gauge on the valve output should read between 350 and 400 p.s.i. If pressure reading does not meet specifications, remove the valve and install a new one.



Fig. 23—You'll need a helper for this test

MAKE SURE YOU USE THE RIGHT VALVE

In the past there has been more than one type of

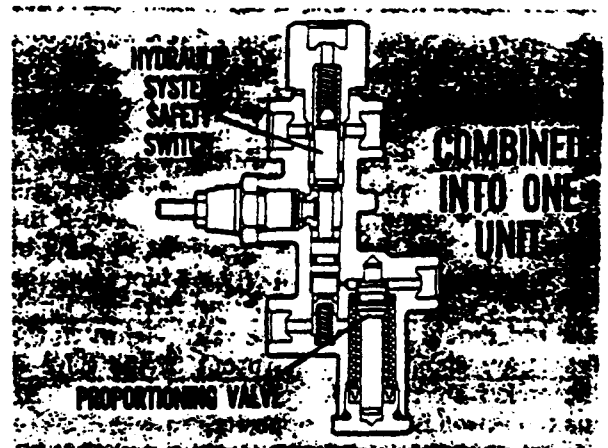


Fig. 24—In production as of January 1, 1970

proportioning valve — one made of brass and one made of cast iron. If you replace a proportioning valve, use the brass type, regardless of whether the car had a brass or a cast-iron valve. And, as of the first of the year, the hydraulic system safety switch and proportioning valve have been combined into one unit. Don't let it throw you though, they're still the same parts and work the same way, only they're both in one housing.

YOU DON'T NEED TWO VALVES

If you install a new safety switch, do not install one with the integral proportioning valve unless the car was so equipped in the first place. If you install a combination switch and proportioning valve on a brake system that doesn't require a proportioning valve, you'll get pressure regulation to the rear brakes when it isn't necessary. If you install the combination switch and valve on a model that has a separate proportioning valve, you'll have two valves regulating pressure to the rear brakes which will further limit braking power at the rear wheels.

FLOATING CALIPER DISC BRAKES NEED METERING VALVE

The floating caliper disc brakes on full-sized cars are designed for excellent balance with the rear drum brakes. However, on intermediate models it is desirable to *reduce* front wheel braking on icy or extremely slippery road conditions. The metering valve cuts off pressure to the front brakes in the ten to one-thirty-five p.s.i. range.

SERVICE AND TESTING

The metering valve is serviced as an assembly so you won't have to be concerned with repairing it if it goes bad. To quick-check the metering valve, park the car and apply the brakes gently ... motor running if equipped with power brakes. A very slight "bump" or change in pedal effort will be felt after about one inch of pedal travel if the valve is working right. This signals the opening of the valve. If you have a helper, have him apply the brakes as you watch the metering valve push rod. The rod should move into the valve slightly as the brakes are applied, and move out of the valve as the brakes are released. On models prior to 1970, the rod action is just the opposite.

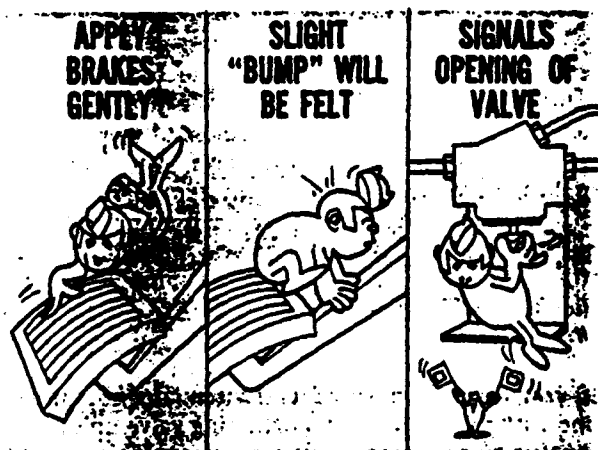


Fig. 25—Bump will be felt after about one inch travel

BLEEDING WITH METERING VALVE

Gravity bleeding is preferred on disc brake systems; but if you use a pressure bleeder on a system with a metering valve, be sure to keep the metering valve open. That's because pressure bleeders are usually operated at about 30 p.s.i. and this pressure will close the metering valve and shut off flow to the front brakes. Use tool C-4121 to hold the push rod open while bleeding the brakes. On earlier models, hold it open by hand or tape it open. And don't forget to remove the tool or tape when you're through. If you happen to forget, full pressure will act on the diaphragm inside when the brakes are applied. This could rupture the diaphragm and result in a ruined metering valve. While we're on the subject, if you replace *any* component, or disconnect *any* line in the system, you'll have to bleed the brake system after you reconnect the lines. Don't overtorque the fittings; and a good way to

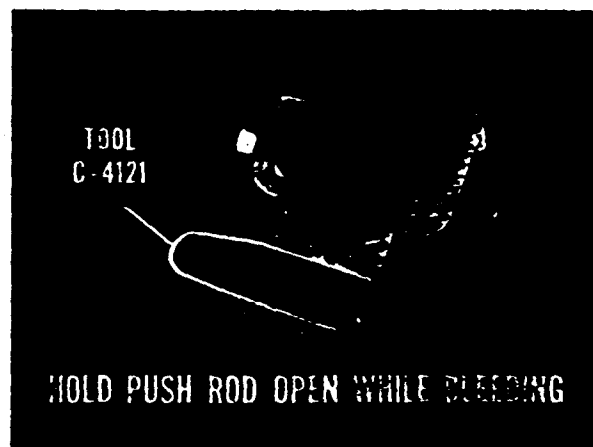


Fig. 26—Be sure to remove tool after test

avoid damaging the tube nuts and brass seats is to use special wrenches designed for tube nuts.

A FINAL NOTE TO AVOID CONFUSION

The *proportioning* valve is located between the *safety switch* and the *rear* brakes. The *metering* valve is located between the *safety switch* and the *front* brakes. That's why one of the outlets is *plugged* on the safety switch when used with a metering valve. The metering valve acts as the "tee" for fluid distribution to the front brakes.

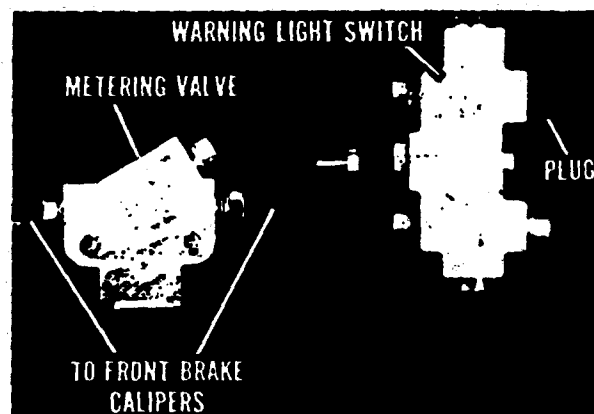


Fig. 27—Metering valve acts as "tee"

REMEMBER THIS, TOO

The *proportioning* valve *regulates pressure build-up* to the *rear* brakes to minimize rear wheel skids on hard brake applications. The *metering* valve *holds off* pressure to the *front* brakes under *light* braking to minimize front wheel skids on icy or wet surfaces.



1970 MODEL REPLACEMENT MASTER CYLINDER IDENTIFICATION CHART

Brake Type	Replacement Cylinder Package Part No.	Cover Retainer	Line Connections	Bore End Stamp
V, L - Drum Manual & Power	3420961	Bolt	Outboard	None
B, J - Drum Manual Only	3420961	Bolt	Outboard	None
All Other Drum Manual & Power	2808577	Bolt	Outboard	None
V, L - Disc	2808600	Bail	Outboard	A
R, W - Disc (Taxi) Manual	2944479	Bail	Outboard	None
B, J - Disc (Exc. 426 Eng.)	2944453	Bail	Outboard	B
R, W - Disc (Exc. 426 Eng.)	2944477	Bail	Inboard	D
B, J, R, W - Disc (With 426 Eng.)	2944476	Bail	Outboard	B
P, D, C, Y - Disc	2883089	Bail	Outboard	None
Model Code: J - Challenger B - Barracuda V - Valiant L - Dart R - Belvedere W - Coronet P - Plymouth D - Dodge C - Chrysler Y - Imperial				

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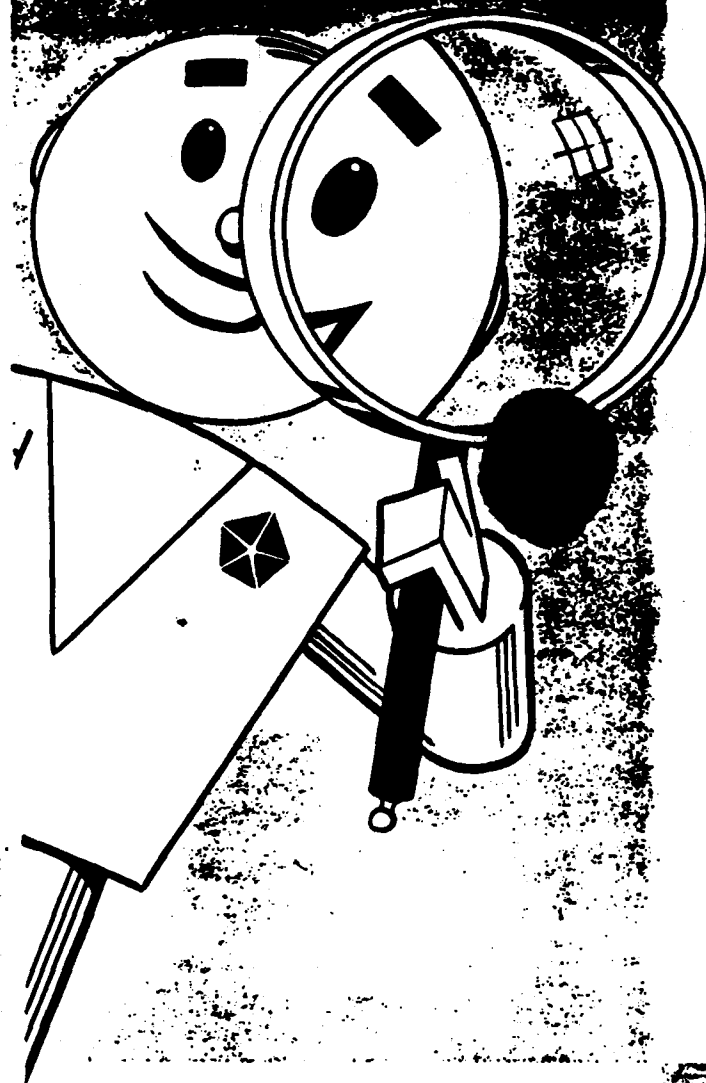
DISC BRAKE SERVICE ROUNDUP

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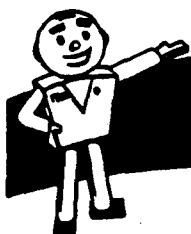
Little Things can be Important...

One of the marks of a Master Technician is his close attention to detail. When troubleshooting, he is alert for even the smallest clue, and in servicing operations, he checks each step with an inspector's care and thoroughness.

Such obvious things as soft and leaky brake caliper piston seals lead him to suspect something else as the basic cause of the trouble. He knows that hydraulic system rubber parts work well with brake fluid, but break down when exposed to small amounts of oil, so he handles these parts with special care.

He also knows that minor damage to parts may seem to be unimportant, but if ignored, can open the way to serious consequences. After all, it's easy to nip or displace a piston dust boot when prying a piston back to make room for new brake shoes, and it only takes a small opening to let dirt and corrosive road splash in to damage the piston and its bore. Little things yes, but important, and that's what this session is all about . . .

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INTRODUCTION

Since their general introduction a few years ago, disc brakes are now used on more and more Chrysler Corporation passenger cars and light-duty trucks either as standard or optional equipment. Two basic disc brakes are currently used, one a four-piston, fixed-caliper type for small-size cars; the other a single-piston, floating-caliper type for all of our other cars and light trucks.

Experience shows that disc brakes are dependable, durable, and practically trouble-free under all normal operating conditions. Relining is a simple job which takes about the same amount of time as the comparable operation on drum brakes. However, disc and drum brake servicing procedures differ, so the technician must familiarize himself with an additional set of do's and don'ts that are peculiar to disc brakes.

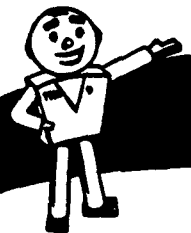
Under the heading of servicing advantages, new disc brake linings do not require any grinding as drum brakes do because the mating disc and lining surfaces are both flat. Also, because the lining clearance is directly self-adjusting, there is no need for any initial shoe adjustment.

General Precautions

- Because the caliper must be dismantled before the disc can be removed, the wheel, tire, and disc cannot be removed as an assembly.
- Be careful when removing or installing front wheels on a fixed-caliper brake installation to pre-

vent damage to a caliper bleed screw or to a hydraulic transfer tube.

- Correct front wheel bearing setting is very important to proper disc brake operation. Loose wheel bearing adjustment allows disc wobble which can produce excessive running clearance between the linings and the disc. Under these conditions, the brake pedal must travel farther than normal to apply the brakes.
- Piston dust boots must be intact and correctly installed to protect the pistons and bores against dirt, grit, and corrosive road splash. As with drum brakes, evidence of hydraulic fluid leakage around piston areas calls for inspection, repair, or parts replacement as necessary.
- When raising a vehicle on a hoist, position it on the lift so the disc brake splash shields are clear when the wheels are turned full left or right. A bent shield can scrape against the disc.
- Remember that the master cylinders used on disc brake vehicles do not have a residual pressure valve in the front brake (rearward) section. A valve here would hold low residual pressure in the system which would prevent proper brake shoe retraction and cause a light brake drag.
- Because the self-adjusting action can allow more than normal pedal travel after relining or other brake servicing, make sure that the brake pedal is firm before you move the car. Anything can happen if the pedal goes to the floor on the first push.



FIXED-CALIPER BRAKE SERVICING HIGHLIGHTS

The fixed-caliper-type disc brake currently used on Valiant, Dart, Cricket, and Colt models has four

pistons in each caliper assembly. The Valiant and Dart share the same size caliper, while the two sub-



compacts have smaller calipers which differ slightly in design details.

As the name suggests, the caliper housing of this brake is mounted in a fixed position on the steering knuckle and spindle assembly. Other than the disc, the only moving parts are the pistons and brake shoes.

EQUAL FORCE AT FOUR POINTS

When the pedal is pressed, equal hydraulic pressure is applied to all four pistons in each caliper, and since they are equal in size, the pistons press the shoes against the disc with equal force.

DUST BOOT SEALS OUT CONTAMINANTS

For protection, an expandable dust boot on each piston seals out road dirt and splash when the piston is extended or retracted. The boot covers the highly finished, chrome-plated sealing surfaces of the piston, but if it is punctured, torn, or improperly installed, contaminants can get through and piston scoring or corrosion usually results. The piston surface then roughens and causes seal leakage. Corrosion can make piston movement sluggish or may even cause the pistons to stick tightly in their bores.

PISTONS MUST MOVE FREELY

Jammed or sticking caliper pistons can be the basic cause of other braking problems. A hard pedal and reduced front brake efficiency can result from sticking pistons. Of course, the linings will wear out prematurely if pistons and shoes do not retract properly when the pedal is released.

STUCK PISTONS DO NO WORK

When a piston is stuck tight in its bore, it cannot

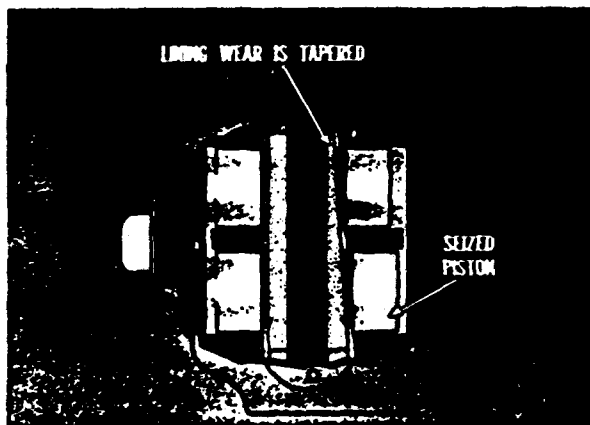


Fig. 1—Stuck piston causes uneven wear

apply any braking pressure on the shoe. As a result, when one brake caliper has stuck pistons, you will get brake pull toward the opposite side which is working properly. If only one piston in a caliper sticks, braking will be reduced, but usually there is little or no brake pull to either side.

LINING WEAR IS A CLUE

If both pistons stick or jam on one side of the caliper, the efficiency of that brake is greatly reduced. When only one piston sticks, lining wear is uneven and tapered, with the thick end over the seized piston.

CHECK PISTON MOVEMENT

Before you remove a caliper for any reason, check the pistons for free movement. Bridge the open end of each piston with a piece of metal so you can apply even force and then squeeze the piston back into its bore with plier pressure.

MAKE ROOM FOR NEW LININGS

When installing new shoes after checking piston movement, you can make the job easier by pushing all the pistons back into their bores to provide clearance for the new, thicker linings. Here you bridge both pistons on one side of the caliper at the same time so you can force them into their bores evenly. Remember that moving the pistons into their bores raises the fluid level in the master cylinder reservoir. Check the level first, and if full, remove enough fluid to prevent an overflow when the pistons are pushed in.



Fig. 2—Moving pistons back raises level

INSPECT FOR CORROSION

Any caliper piston that requires excessive movement pressure or feels rough when forced inward must be inspected for corrosion. For a good look,



you'll have to remove the caliper from the car so you can pull the pistons out of their bores.

DON'T DISTORT THE TUBE

Before you separate the caliper housing sections, disconnect the transfer tube so it won't be bent or distorted. The tube is specially shaped and routed over a ledge on the caliper end to keep it away from the rim of the disc, but if bent outward, it might scrape on the inside of the wheel.

SOFT JAWS ARE A MUST

When working on a caliper in a vise, be sure to use soft jaw facings so you won't damage caliper mounting or mating surfaces. In all cases, do not grip the housing in a way that can distort the bores or jam the pistons.



Fig. 3—Piston cocking can cause damage

USE SPECIAL PULLING TOOL

With the caliper housing sections separated, peel off the dust boots and remove the pistons with the C-3999 Special Tool. Do not try to remove pistons by prying because they may cock and cause serious damage to the pistons and bores.

REMOVE SEALS WITH CARE

Use a pointed wood or plastic stick to remove piston seals from the caliper grooves. Screwdrivers or similar tools with sharp edges can scratch the bore surfaces and may burr the seal groove edges, either of which can result in leaks. Discard used seals and dust boots whenever pistons are removed.

REPLACE OR RECONDITION PARTS

Pistons which are scored or pitted, or those with the chrome plating worn through must be replaced. Lightly scratched or rusted bores can be cleaned up



Fig. 4—Protect bores and grooves

with crocus cloth. Those with deep scratches or scoring can usually be restored to acceptable condition by honing. Seal groove edges must be in good condition to properly retain a seal ring and to keep it in tight contact with the piston.

OIL RUINS RUBBER PARTS

Of course, you've got to wash the parts after honing, but do not under any circumstances, use kerosene or any other oil-based solvents because they will ruin seals and other rubber parts in the brake hydraulic system. Flush or scrub the parts thoroughly with clean brake fluid or alcohol to make sure that there is no oil, grease, or grit in the passages or seal grooves. Ordinary rubbing alcohol is inexpensive and does a good cleaning job.

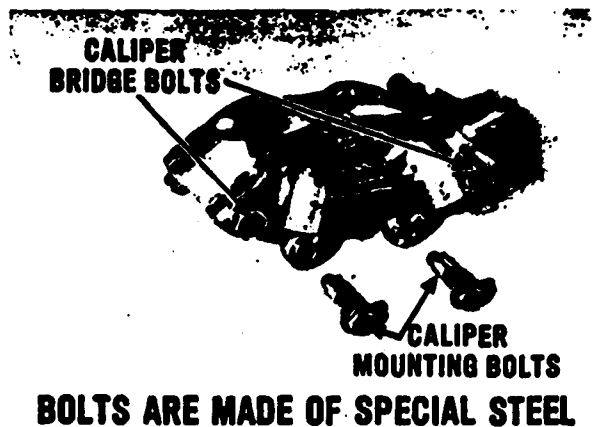


Fig. 5—Re-use original bolts

BOLTS ARE MADE OF SPECIAL STEEL

The caliper bridge bolts and mounting bolts are made of special tensile strength steel to withstand

maximum braking stresses. For this reason, it is important to re-use the same special bolts when assembling and installing the caliper. Be sure to torque these bolts properly so they will not stretch or loosen.

CLIP POSITION IS IMPORTANT

If a new brake hose is installed, the hose retaining clip must be installed properly on the hose mounting bracket or it may catch and pull loose. Just make sure that the open end of the installed clip faces away from the caliper.

DISC MUST RUN TRUE

Don't overlook the importance of checking the brake disc for runout and thickness variation before you reinstall a caliper, or when there is a complaint about excessive pedal travel or brake operating roughness.

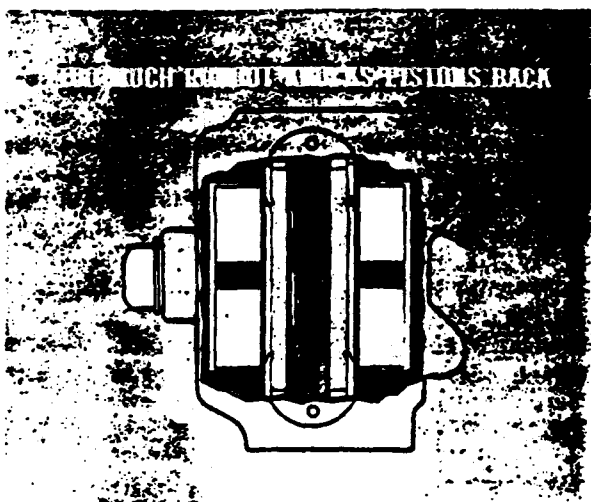


Fig. 6—Runout widens lining clearance

LINING CLEARANCE AFFECTS PEDAL TRAVEL

Too much disc runout knocks the pistons back into their bores and this increases the running clearance of the linings. This unwanted clearance must be taken up before the linings contact the disc to produce braking, so the pedal has to travel farther than normal.

THICKNESS VARIATION CAUSES PULSATION

Brake roughness or pedal pulsation is the usual result of excessive variation in disc thickness. In this case, the pistons move in and out as they follow disc thickness variations and this causes pedal pulsation and braking vibration.

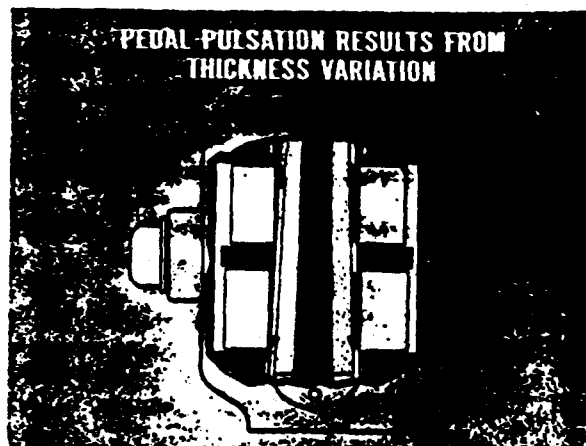


Fig. 7—Pistons move in and out

BEARING ADJUSTMENT IS IMPORTANT

Don't forget that accurate disc runout checking and good brake operation are both affected by wheel bearing adjustment. If the disc wobbles because of loose bearings, the effect can be the same as with excessive runout or thickness variation.

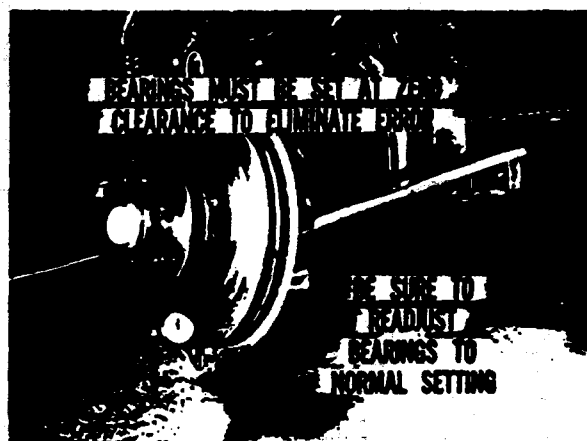


Fig. 8—Adjust bearings correctly

USE ZERO CLEARANCE FOR CHECKING

A fixed-caliper disc should be replaced if its runout exceeds specified limits. These limits are quite narrow, so the wheel bearings must be set at zero clearance to eliminate indicator error. If the disc checks out okay, be sure to readjust the bearings to the normal setting.

Cricket-Colt Fixed-Caliper Service Hint

On some Crickets, you may find the front brake lining worn out prematurely as a result of brake



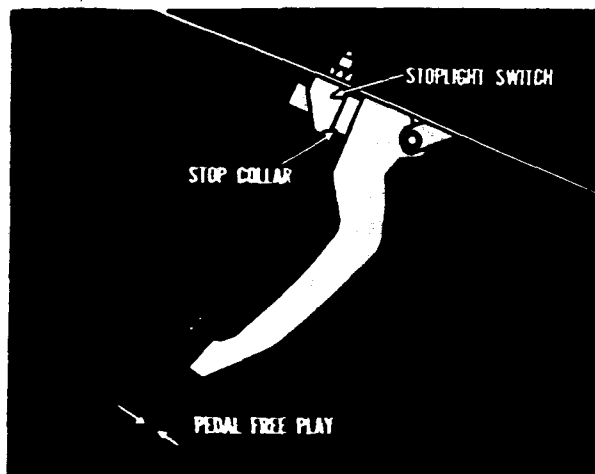


Fig. 9—Collar compression loads pedal

drag. When you find this condition, be sure to check the brake pedal for the specified free play. If the pedal stop collar on the stoplight switch must be compressed to make the lights shut off, it can remove all the free play and may even produce light pedal pressure. The best remedy for this condition is to remove and discard the stop collar so you can get the correct pedal clearance.

VALVE MUST OPEN

In addition to eliminating the possibility of unwanted pedal pressure, pedal free play is also needed to make sure that the compensating valve in the master cylinder can open properly when the pedal is released. The valve must open to relieve system pressure and permit full brake shoe retraction. If a small amount of pressure is trapped in the system, the brakes can drag.

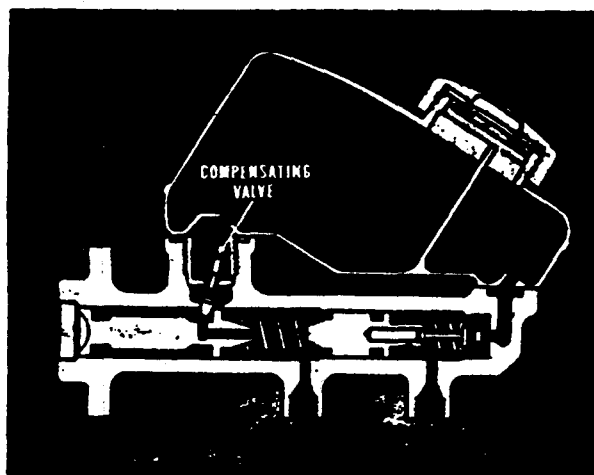


Fig. 10—Valve relieves system pressure

SWITCH MUST BE RESET

The Cricket brake warning light switch does not reset automatically and the signal will remain lighted until the switch piston is moved back to neutral position by hydraulic pressure. Once the reason for the pressure drop in either system is corrected, bleeding the other system allows the higher pressure to reset the piston and shut the light off.

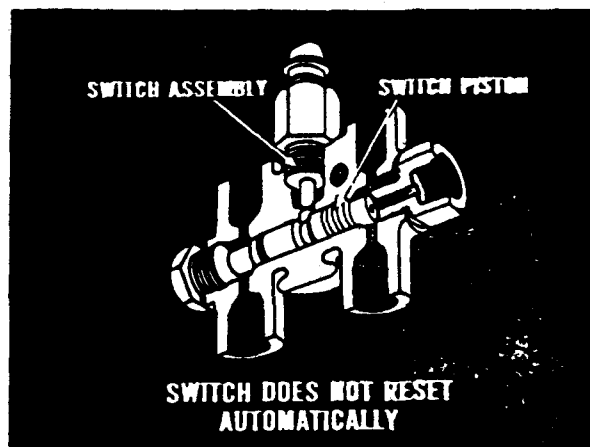


Fig. 11—Bleed brakes to recenter piston

PISTON CAN MOVE PAST CENTER

When Cricket brakes are bled for any reason, the job must be done carefully, following the procedure given in the Service Manual. If too much pressure is applied, the switch piston may be forced out of, or past, neutral position and the warning light will light and stay on.

TURN 'EM UPSIDE DOWN

On some Colts, you may get a wire brush squeal, which is heard when starting to move the car or

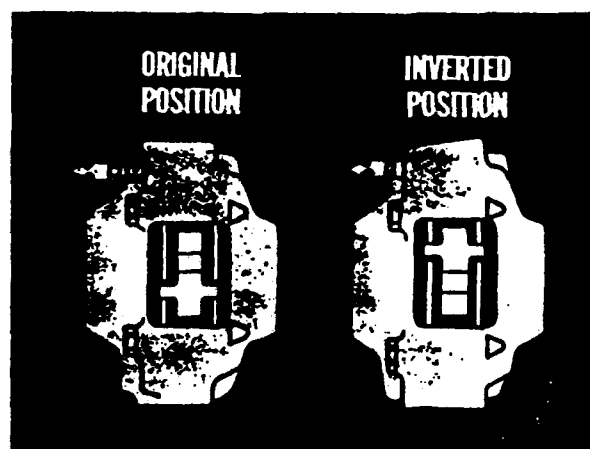


Fig. 12—Invert caliper cross springs

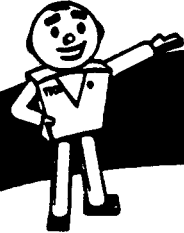


while driving at slow speeds. This is a high-frequency vibration sound which can usually be corrected by inverting the brake shoe cross springs to put the long ends down instead of up.

SHORT CIRCUIT MAKES LIGHT GLOW

Don't jump to conclusions when you find a Colt with a brake warning light which shows a dull glow. On these cars, the switch piston resets auto-

matically and the light should go out completely when no pedal pressure is applied. In most cases, the dull glow is caused by an internal short circuit which can be corrected by installing a new switch terminal. Because the switch piston center section is sealed off by "O" rings, no bleeding is necessary when replacing the terminal. The switch terminal seals can be damaged if the terminal is overtightened, so be careful when replacing these parts.



FLOATING-CALIPER BRAKE SERVICING NOTES

The floating-caliper-type disc brake is available on light-duty trucks and all passenger cars except compact and sub-compact models. Servicing procedures are similar to those for the fixed-caliper type used on Valiants and Darts except that the caliper housing must be removed from the adapter to replace the brake shoes.

BRAKE SQUEAL AT LOW SPEEDS

As with other brakes, some floating caliper brakes produce noise under certain conditions. Typically, this is a high-pitched squeal that sounds off on light brake applications at speeds generally below forty miles an hour.

SHOE VIBRATION CAUSES NOISE

The usual cause of the squealing noise is a vibrating, metal-to-metal contact between the back plate of the outboard shoe and the caliper fingers. Of course, such things as badly worn linings, scored discs, worn guide pins or pin bushings and corroded pistons can also cause noise and should be corrected first.

STABILIZE SHOE TO QUIET NOISE

If inspection shows the brake to be in good condition, the vibration sound can be quieted by stabilizing the outboard brake shoe with contact cement. The caliper must, of course, be removed so the cement can be properly applied.

PRY BACK PISTON

Before removing the guide pins to dismount the caliper, pry the piston into its bore so the caliper will be easier to reinstall. Simply insert a bar into one of the cooling pockets in the disc rim and pry

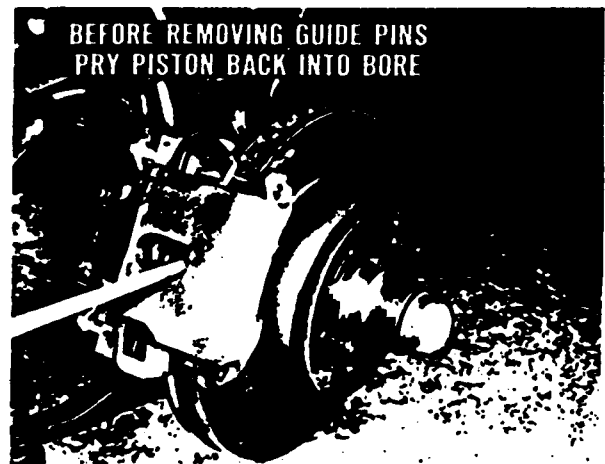


Fig. 13—Guard against boot damage

against the outer side of the caliper hole, being careful not to disturb the dust boot. Remember that it only takes a small nip or cut to let dirt or road splash through the protective boot.

REMOVE OUTBOARD SHOE

Take out the guide pins and slide the caliper off of the adapter. Support the caliper to keep its weight off of the brake hose and remove the outboard shoe so the cement can be applied correctly. Clean the dirt and rust from the shoe back plate and the caliper finger surfaces which bear on the plate.

CLEAN BUT DO NOT POLISH

Use medium-grit sandpaper, emery cloth or a wire brush to clean the metal surfaces but leave them slightly rough so the cement can make a good bond. Be careful to keep grease and oil away from





APPLY THICK COATING OF CEMENT AND ALLOW TO AIR DRY

Fig. 14—Coat shoe and caliper surfaces

the lining surfaces or the job may bounce back with a hard pedal or brake pull, even though the noise is gone.

LAY IT ON

When all the parts are cleaned, apply a thick coating of Cycleweld cement (Part No. 3683897) in a band across the back of the outboard shoe and on the shoe contacting surfaces of the caliper fingers. Allow the cement to air-dry for at least fifteen minutes or until the surface of the coating dulls.



Fig. 15—Shoe alignment must be correct

ALIGN SHOE ON GUIDE PINS

To properly position the coated outboard shoe, insert the caliper guide pins backward through the small outboard bushings so they extend in toward the piston about one inch. Then, align the shoe on the pins, press the cemented surfaces together and pull out the guide pins.

LEAVE SPRING OFF

Position the caliper on the adapter and install the guide pins in the correct manner. The cement attachment eliminates the need for the anti-rattle spring, so it can be left off. This is the reason why you'll find new, current model car and light-duty truck disc brakes without anti-rattle springs.

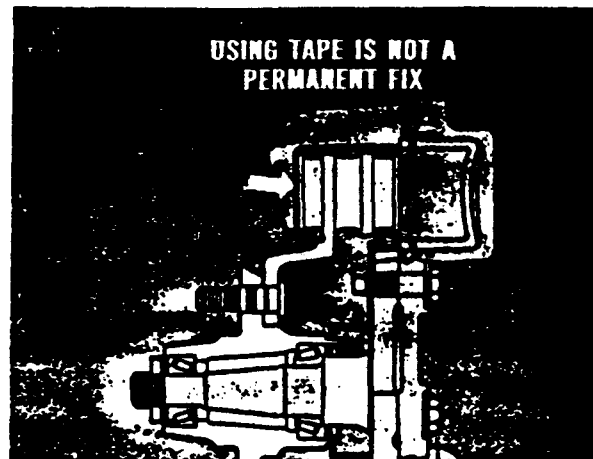


Fig. 16—Noise will return

WARNING: Do not use masking tape or other temporary substitutes in place of contact cement to stabilize outboard shoes because the fix is not permanent and the noise will return.

DUST BOOT MUST BE INTACT

As with fixed-caliper-type brakes, you'll find that a punctured, torn, or improperly installed dust boot can result in piston corrosion or scoring in a floating-caliper brake.



Fig. 17—Inspect boot carefully

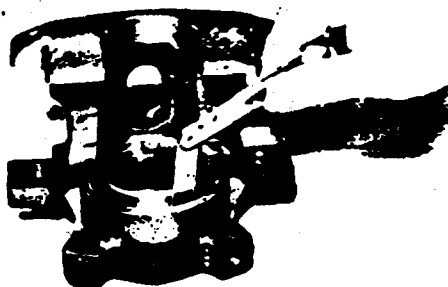
OPEN FOR INSPECTION

When you suspect a stuck or slow-moving piston, inspection is the answer. Here again you can make the job easier if you pry the piston back into its bore before removing the caliper. In fact, when relining, you can check for free piston movement and force the piston back to accept the new, thicker linings in one step.

PRESS THE PEDAL SLOWLY

To remove a stuck floating-caliper piston you can use brake system hydraulic pressure. Support the caliper assembly on the upper control arm using shop towels or a pan to catch the brake fluid. Slowly press down the brake pedal to push the piston out of its bore. You'll feel a drop in pedal pressure when the piston is out. The pedal should be propped up after the piston is out to prevent additional loss of brake fluid. Be sure that you don't get fluid on the linings.

CAUTION: Do not under any circumstances try to remove a caliper piston with air pressure. The stuck piston can break loose suddenly and cause serious damage or personal injury.



CLEARANCE MUST NOT EXCEED .006"

Fig. 18—Measure with seal out

DON'T EXCEED LIMITS

If the bore is honed to clean up pits or deep scratches, piston clearance must not be greater than .006 of an inch. To check clearance, leave the seal out and measure the space between the piston and the bore wall with a feeler blade.

GET IT OUT OF THE GROOVES

After honing a caliper bore, be sure to clean the seal and dust boot grooves carefully with a stiff bristle brush. Flush out all grit from the grooves



FILL GROOVES WITH LUBRICANT

Fig. 19—Lube serves as rust preventive

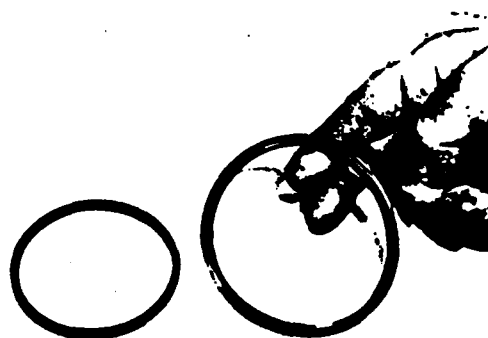
and passages with clean brake fluid or alcohol and wipe the grooves dry with lint-free cloth.

APPLY LUBRICANT FIRST

Before you install a new piston seal and dust boot, fill the grooves with the Ucon lubricant (Part No. 3579255) packed in the seal kit. This special lube is compatible with brake fluid, and can be used without fear of contamination. It serves as a rust preventive to protect the bore and makes the piston and dust boot easier to install.

THE WORD IS CLEAN

The importance of keeping brake hydraulic parts clean cannot be over-emphasized for two major reasons. First, any foreign particles in the system can cause scoring of parts and may also interfere with correct control valve operation. Second, the slightest trace of oil in the system or from careless handling will cause seals to fail prematurely.



SEALS SWELL AND DISTORT WHEN EXPOSED TO OIL

Fig. 20—Use clean brake fluid or alcohol

OIL SWELLS SEALS

Brake hydraulic system seals and other rubber parts work well with brake fluid but will swell and distort when exposed to oil or petroleum-based cleaning solvents. To observe the effects of oil on these parts, try leaving a piston seal in a pan of oil for a day or two.

CLEAN HANDS FOR CLEAN PARTS

Before assembling any hydraulic parts, the careful technician will clean his hands to get rid of dirt, oil, or grease which can cause contamination. Generally speaking, all seals, pistons and other similar parts should be thoroughly lubricated with clean brake fluid before assembly.

NEW BUSHINGS RESTORE ORIGINAL CHARACTERISTICS

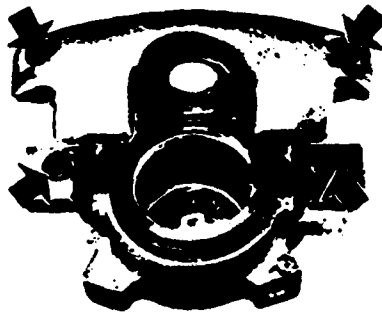


Fig. 21—Replace bushings on reline

USE NEW BUSHINGS

Be sure to install new guide pin bushings when you reline the brakes. New bushings restore the original braking and self-adjusting characteristics which are

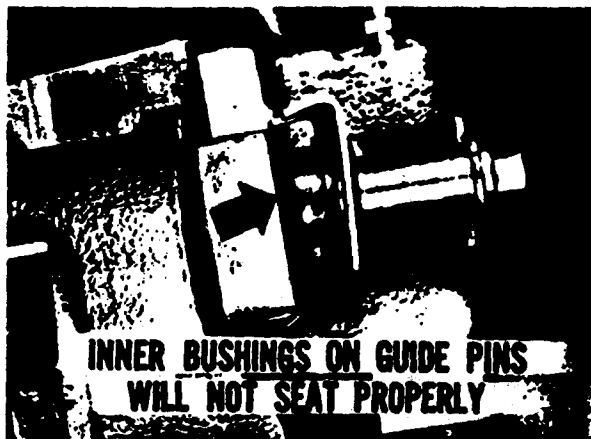


Fig. 22—Guide pins expand bushings

affected by the friction of the bushings moving the guide pins.

BUSHINGS EXPAND ON PINS

Before you install the relined caliper, be sure seat the new guide pin bushings in the caliper holes. If you slip the inner bushings on the guide pins first, they expand larger than the caliper hole and will not seat properly.



BE SURE TO INSTALL NEW POSITIONERS

Fig. 23—Used positioners close up

DISCARD USED POSITIONERS

Always install new caliper positioners on reline jobs because the used ones remain closed up as a result of compensating for lining wear. In this closed condition they cannot retain the inner bushings properly when the new linings are installed.



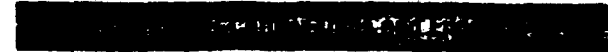
Fig. 24—Install positioners correctly

INSTALL POSITIONERS PROPERLY

The upper and lower positioners are different and must be installed with the stamped arrows pointing



upward and the alignment tabs seated on the machined caliper surfaces. If not installed properly, the positioners will collapse when the guide pins are installed.



You may have noticed that disc brake outboard linings usually show less wear than the inboards. This is a normal condition and should not be inter-

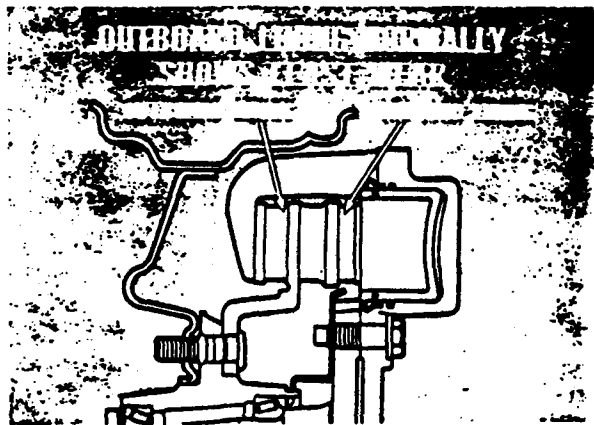


Fig. 25—Wheel protects lining

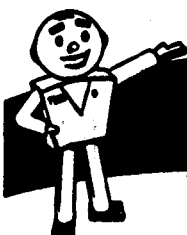
preted as a brake defect. The wheel practically encloses the outboard side of the caliper so it is not exposed to as much gritty dirt and road splash as the inboard side. It's as simple as that!

REMOVE CALIPER ONLY

As mentioned elsewhere, the floating caliper must be removed to reline the brake. However, some brake men, for various reasons, do the job the hard way by removing both the caliper and the adapter as an assembly. This, of course, is unnecessary and extra work because, as everyone should know, you simply remove the caliper guide pins and slide the caliper off to remove the shoes.

CHECK THE HOSES

All hydraulic brake hoses should be inspected every six months or 6,000 miles on vehicles in general use, and every three months or 4,000 miles on those in police or taxi service. A twisted hose that takes a set or rubs against some other part must be replaced. A hose with a cracked outer cover should be replaced because it will admit moisture which will cause further hose deterioration. A split or cracked hose cover can also result in ballooning or hose rupture, either of which will cause brake failure. Fluid seepage around the hose end fittings also calls for hose replacement.



DISC BRAKE HYDRAULIC SYSTEM CONTROL VALVES

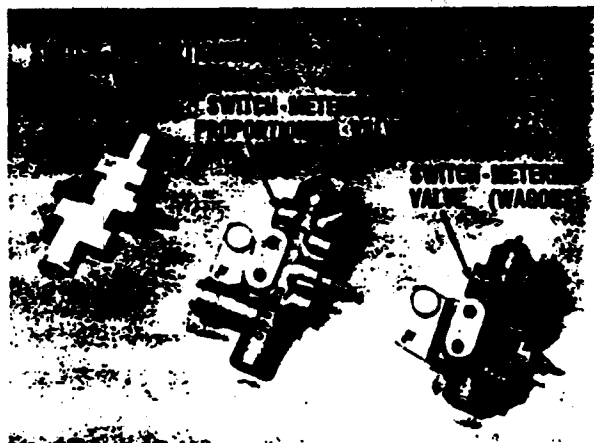


Fig. 26—Typical system control units

Since disc brakes operate at higher pressures than drum brakes, some form of control valve is used on these systems to regulate brake operating pressures, front and rear. A new, one-piece control valve unit for 1972 models replaces the separate proportioning and metering valves used on some 1971 cars. The complete disc brake hydraulic system control valve lineup for our 1972 model cars and light-duty trucks is covered in the following paragraphs.

THREE UNITS FOR CARS

Starting with cars, the Valiant and Dart fixed-caliper system uses a combined brake warning switch and proportioning valve unit. In comparison, the floating-caliper system control unit combines a brake warning switch with metering and



proportioning valves, except on Station Wagons, where the unit is a combined warning switch and metering valve.

CONTROL UNIT IS A CARRYOVER PART

The switch and proportioning valve unit is the same one-piece, brass-bodied assembly used on the 1971 Valiant and Dart models. The spring-loaded switch piston resets automatically and turns the light out. Except for the switch terminal, which can be replaced separately, this control unit is serviced only as a complete assembly.

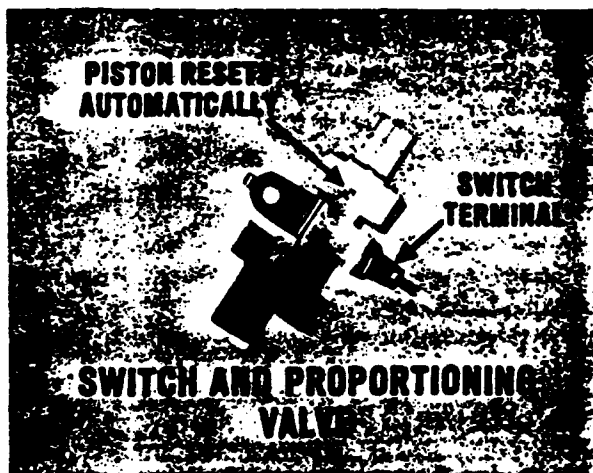


Fig. 27—Used on compact-size models

THREE-IN-ONE UNIT

The new combined warning switch, metering valve, and proportioning valve unit for the floating caliper system has a cast-iron body which resembles

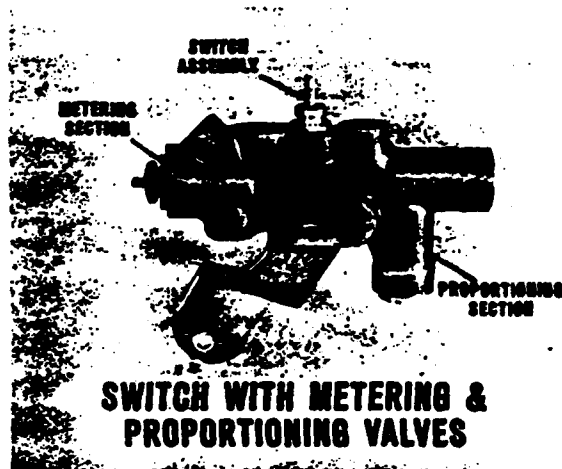


Fig. 28—Used in medium- and full-size Sedans and Hardtops

the switch and metering valve unit used on all full-size 1971 models and all 1972 Station Wagons. Here again, except for the warning switch assembly, the valve is serviced by complete replacement.

VALVE BLOCKS OFF FRONT BRAKES

The metering valve section of the new control unit blocks off the front brakes when system pressure is between 3 and 135 pounds. This allows pressure to build up at the rear brakes before the front brakes to provide good directional and braking control on slippery surfaces.

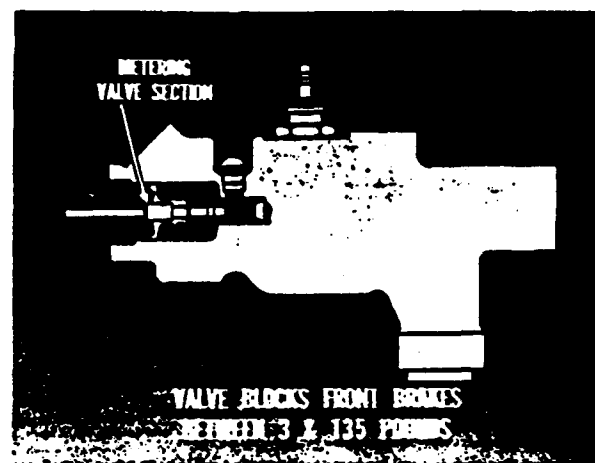


Fig. 29—Valve acts as a shut-off

VALVE REGULATES PRESSURE

The proportioning valve section in the unit operates as the name suggests. It regulates front brake pressure and rear brake pressure in proportion to prevent premature rear brake locking on hard brake applications.

EQUAL PRESSURE FOR EASY STOPS

On light brake applications, the proportioning valve allows equal pressure front and rear, because this pressure is usually not high enough to lock the rear brakes. However, in a hard pedal application, front brake pressure may reach 800 pounds, so the valve reduces rear brake pressure in proportion.

SWITCH OPENS VALVE BYPASS

In the warning switch section of the new unit, a pressure drop on either side allows the higher opposing pressure to move the piston off-center and this pushes the switch plunger upward. When the piston moves into the front brake section of the unit, it also opens a proportioning valve bypass to allow full system pressure at the rear brakes.



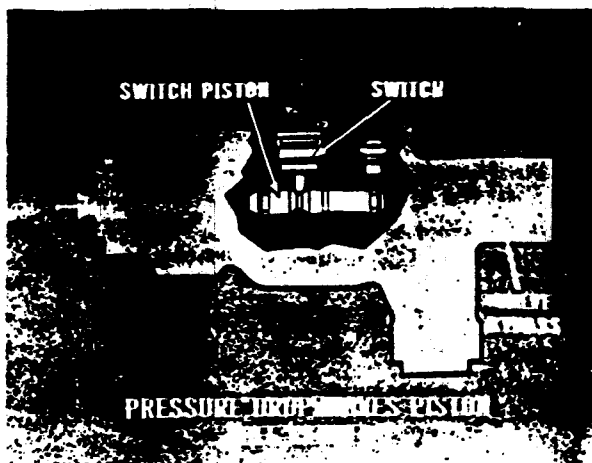


Fig. 30—Piston operates switch plunger

PRESSURE RESETS SWITCH PISTON

The warning switch piston in the new unit is not spring-loaded and is reset by hydraulic pressure. After the cause of the brake problem has been corrected and the brakes have been bled, the piston will recenter and put the warning light out when you apply the brakes with moderate force.

HOLD METERING STEM OUT

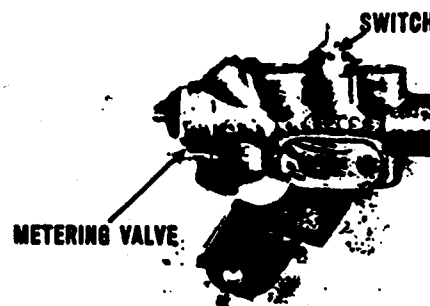
Brake bleeding with the new system control unit is essentially the same as with the earlier two-piece installation. For pressure bleeding, the metering valve stem must be held out with a holding tool to override the valve's shutoff action. Other brake bleeding procedures are covered in detail in the Service Manual.

VERTICAL VALVE TRAPS AIR

On Barracuda, Challenger, and intermediate-size models, the brake system control valve is mounted vertically. Air can be trapped in the rear section of these valve units unless special bleeding procedure is used.

TURN THE LIGHT ON

To properly bleed the brakes where a vertical-mount control valve unit is used, you turn the ignition switch on and make sure that the parking brake is off. Then crack either front caliper bleed screw and press the pedal to move the switch piston and turn the warning light on. Next, you bleed the rear brakes, then the front brakes, and finish by resetting the switch piston with moderate pedal application force.



SWITCH WITH METERING VALVE UNIT HAS NO PROPORTIONING VALVE SECTION

Fig. 31—Used on Station Wagons

SIMILAR BUT DIFFERENT

The warning switch with metering valve control unit used on 1972 model Station Wagons works essentially the same as the three-section unit except that it has no proportioning valve section. As in the three-section valve, only the warning switch can be replaced as a separate part.

SEPARATE UNITS FOR TRUCKS

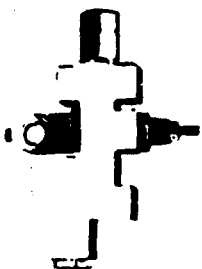
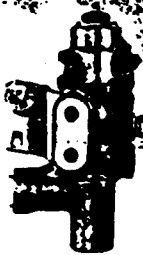
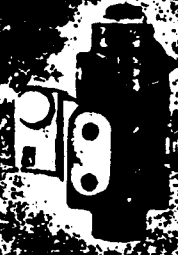
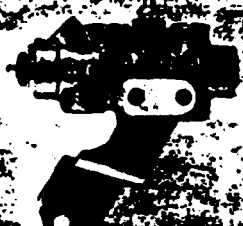
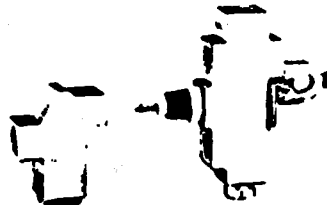
On light-duty trucks, two basic disc brake systems are used. The B100 and B200 Compact Wagons and Vans have a proportioning valve and a separate brake warning switch. The B300 Compact Wagon and D100 through D300 Pickups have a brake warning switch only. The warning switches reset automatically and servicing is on the same unit-replacement basis as passenger cars.



Fig. 32—Used on light-duty Trucks



1972 DISC BRAKE HYDRAULIC SYSTEM CONTROL UNITS

WARNING SWITCH-PROPORTIONING VALVE UNIT	SWITCH-METERING & PROPORTIONING VALVE UNIT—VERTICAL MOUNT	SWITCH-METERING VALVE UNIT —VERTICAL MOUNT
		
VALIANT & DART	SATELLITE & CORONET—(EXCEPT STATION WAGONS) BARRACUDA & CHALLENGER	SATELLITE & CORONET STATION WAGONS
SWITCH-METERING & PROPORTIONING VALVE UNIT—HORIZONTAL MOUNT	SWITCH-METERING VALVE UNIT —HORIZONTAL MOUNT	WARNING SWITCH- PROPORTIONING VALVE
		 VALVE SWITCH
FURY, POLARA, MONACO, ROYAL, NEWPORT, NEW YORKER, IMPERIAL —EXCEPT STATION WAGONS	FURY, POLARA, MONACO, TOWN & COUNTRY WAGONS	B100-200 COMPACT WAGONS, & VANS —VALVE & SWITCH B300 COMPACTS & D100-200-300 PICKUPS—SWITCH ONLY

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1973

**Chassis
Service Manual**

**Plymouth
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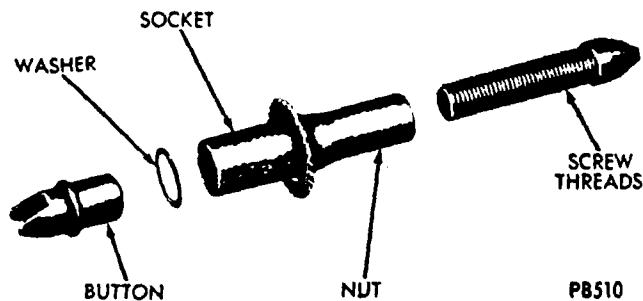


Fig. 9—Adjuster Screw Assembly

they are to be used with to insure that they have the recommended radius grind. This grind, which should provide at least .004 inch heel and toe clearance, is necessary for proper lining to drum contact during brake application.

CAUTION: When resurfacing or refacing brake shoes follow manufacturing recommendations for proper use of their equipment. Whatever equipment is used, ensure that proper ventilation is provided to remove asbestos dust, which can be detrimental to health.

Drum Refacing—Measure the drum runout and diameter with an accurate gauge. There should be no variation in the drum diameter greater than .002 inch. Drum runout should not exceed .006 inch out of round. If the drum runout or diameter variation exceed these values the drum should be refaced. Remove only as much material as is necessary to clean up the drum. It is recommended the front drums be refaced with the wheel and tire mounted. Do not reface more than .060 inch over the standard drum diameter.

NOTE: All drums will show markings of maximum allowable diameter (Fig. 10). For example, a nine inch drum will have a marking of MAX. DIA. 9.090". This marking includes .030" for allowable drum wear beyond the recommended .060" of drum refacing.

BRAKE SHOE INSTALLATION

Installing Front Brake Shoes

Lubricate with a thin film the shoe tab contact area (6 places) on support plate with Chrysler Parts Multi-Purpose Grease, Part number 2932524 or equivalent (Fig. 11).

(1) Match a primary with a secondary brake shoe and place them in their relative position on a work bench.

(2) Install adjusting star wheel assembly between primary and secondary shoes, with a star wheel next to secondary shoe (Fig. 1).

The left star wheel adjusting stud end is stamped "L" (indicating its position on the vehicle) and is also cadmium plated. The right star wheel is black, and the

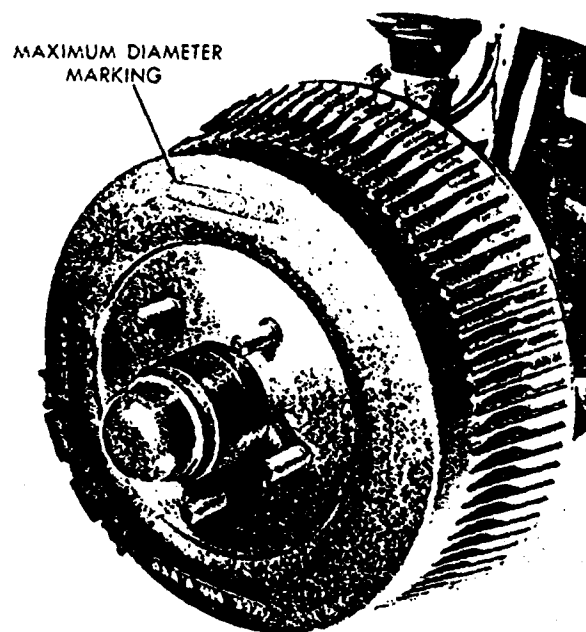


Fig. 10—Nine Inch Drum—Maximum Diameter Identification

adjusting stud end is not stamped.

(3) Install adjuster spring in primary shoe and hook other end in web of secondary. Install adjusting lever spring over pivot pin on shoe web. Install adjusting lever under spring and over pivot pin. Slide lever slightly rearward to lock in position (Fig. 1).

(4) Spread anchor ends of brake shoe to hold star adjusting wheel assembly in position.

(5) Holding brake shoes firmly, place assembly on support plate, and at the same time engage shoe webs with wheel cylinder pistons (Fig. 12).

(6) Using Tool C-4070, install shoe retaining nails springs and retainers. (Fig. 6).

(7) Install anchor plate over anchor.

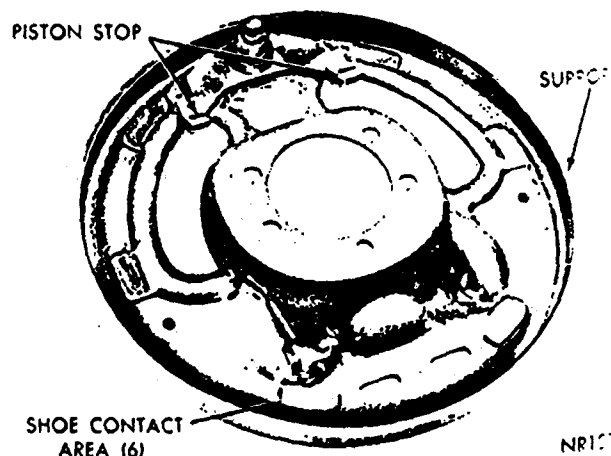


Fig. 11—Shoe Contact Area on Support

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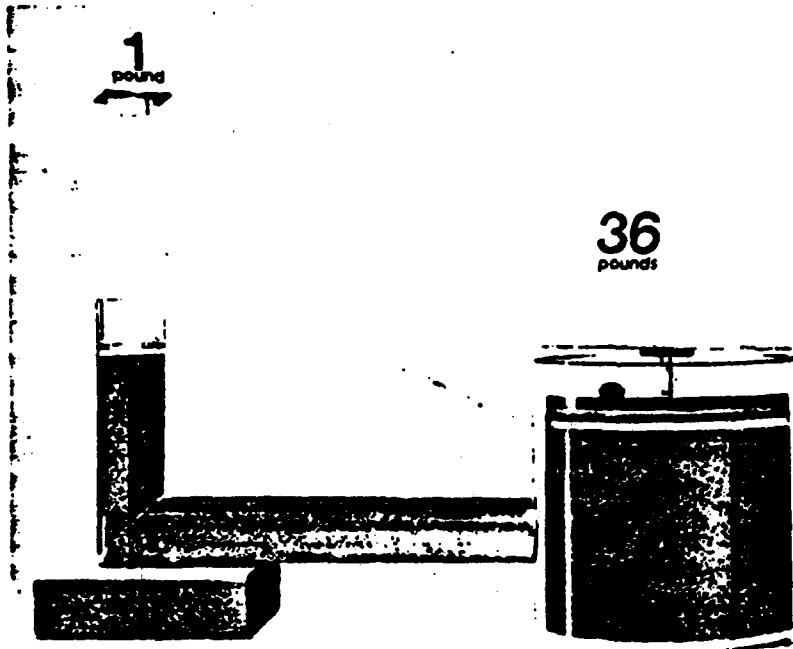


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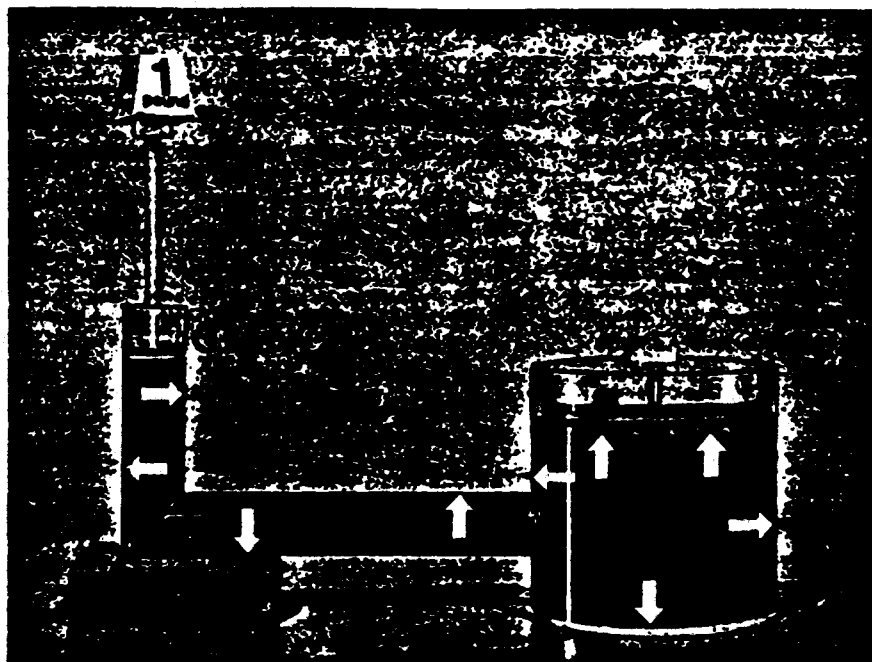
'76 December Reference Book



HYDRAULIC FUNDAMENTALS



SERVICE CONFERENCE



Hydraulics . . . a branch of science you should know a lot about

Hydraulics is the branch of science that deals with the properties of liquids, and with the transmission of energy by means of liquid flow. Without these properties we would have no automatic transmission, no torque converter, no power steering. And we would have to go back to mechanically operated brakes. In short, we depend strongly on hydraulics for some of our most critical automobile operating systems — steering, stopping, and power transfer.

Because of the important jobs hydraulic systems have to perform in an automobile, following the correct service procedures for these systems is especially important.

At the same time, the high reliability of hydraulic systems, plus their self-lubricating quality, makes them generally require little in the way of service other than minor adjustments and routine checks of fluid levels.

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1 LEVERAGE — OUR "CHEAPEST" WAY TO GET POWER

Can a 180-lb. man possibly raise a 1,000-lb. rock? Right off the ground? Yes. If he uses a lever long enough, he can lift an unlimited amount. What he does is use **MECHANICAL ADVANTAGE** with the lever. By moving the **FULCRUM**, or balance point, he trades off distance traveled for power. So if he is satisfied with the small movement he gets at the "out-put" end, he can apply power with a lever that multiplies his weight force many times over.

What has all this to do with hydraulics? Plenty.



Fig. 1 — How does he do it?

2 LIQUIDS — JUST AS STRONG AS STEEL

We started our investigation of hydraulics with the mechanical lever because everyone is familiar with the lever and how it works. Now here's the connection: The principles of hydraulics show properties very similar to those of the mechanical lever.

Hydraulics can provide just as much power as the lever and offer some unique advantages in addition. One of the properties of all liquids is incompressibility. In fact, in a closed system, a liquid is capable of transmitting just as much force as a solid steel bar.

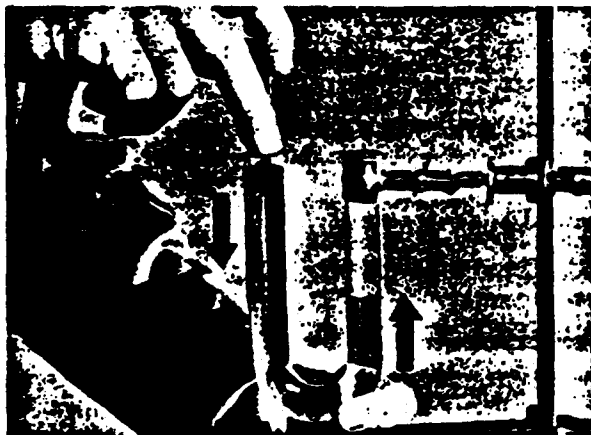


Fig. 2 — 1-to-1 power transfer is easy with liquids.



Fig. 3 — Liquids can transmit power just as well as a steel bar.

3

PASCAL'S LAW AND THE HYDRAULIC LEVER

"If you exert pressure on any part of a closed hydraulic system, the pressure is instantly transmitted undiminished to every other part of

the system." This is the basic law of hydraulics which bears the name of its discoverer, Blaise Pascal.

THE HYDRAULIC LEVER

But look at what happens when we apply Pascal's Law to a system with two unequal size cylinders. (Fig. 4).

Let's apply a force to the piston in the one-inch cylinder such that the pressure on the small piston is one pound per square inch (1 PSI.) According to Pascal, this 1 PSI will appear on every square inch in the system. But notice that this pressure also applies to the area of the 6" piston — an area 36 times larger than the area of the small piston. So the large piston is pressed upward by a force equal to 36 pounds. In other words, one pound on the small piston will balance 36 pounds on the large piston. And a force of 100 pounds on the small piston will accumulate a force of 3600 pounds on the larger "output" piston, and so on.

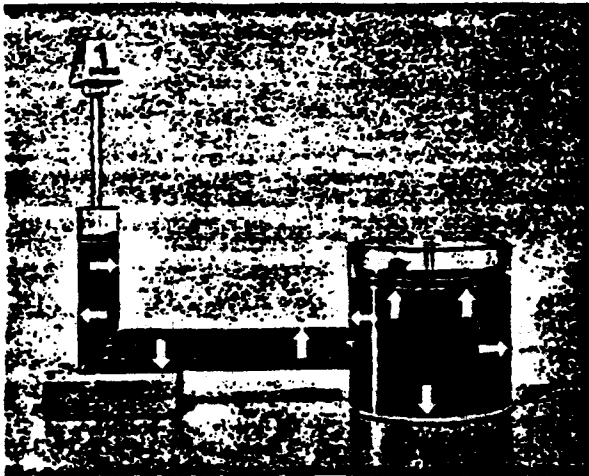


Fig. 4 — "In any closed hydraulic system, pressure exerted anywhere is transmitted undiminished to every part of the system." (Pascal's Law)

ALL LEVERS TRADE DISTANCE FOR POWER
Just as we did with the mechanical lever, we lose something when we use mechanical ad-

vantage to multiply the force with the hydraulic lever. We lose distance moved, or "travel," at the output end.

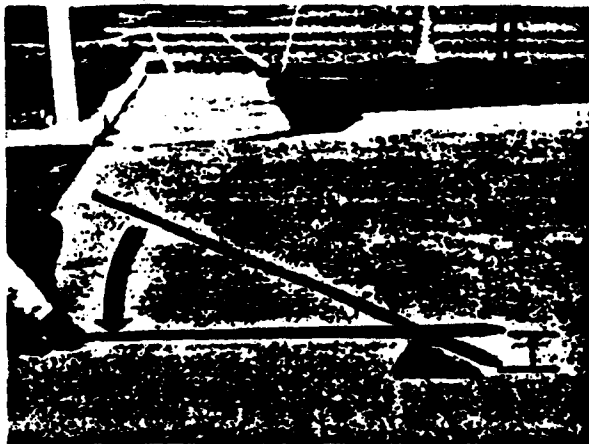


Fig. 5 — To increase power, we give up distance at the output end of the lever.

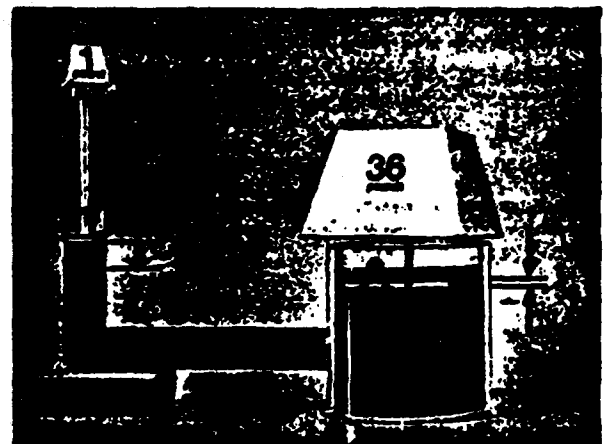


Fig. 6 — One-inch travel at input piston causes only 1/36" travel at 6" output piston.



Fig. 7 — This small hydraulic press can exert 10 tons of force.

THE HYDRAULIC PRESS

The hydraulic press is an application of Pascal's law that shows the force which can be achieved with the hydraulic lever. The pumping unit on the right in Fig. 7 is capable of delivering an input pressure to the press of 10,000 lbs. per square inch. Since this pressure accumulates in an air reservoir by hand pumping, the press is sometimes called "air-hydraulic." But the principle is the same. The air simply accumulates the force which presses on the small input piston — with up to 10,000 PSI. From this piston, the pressure is transmitted by a hydraulic line to the larger (2.5" dia.) output piston where it is multiplied as high as 60,000 PSI.

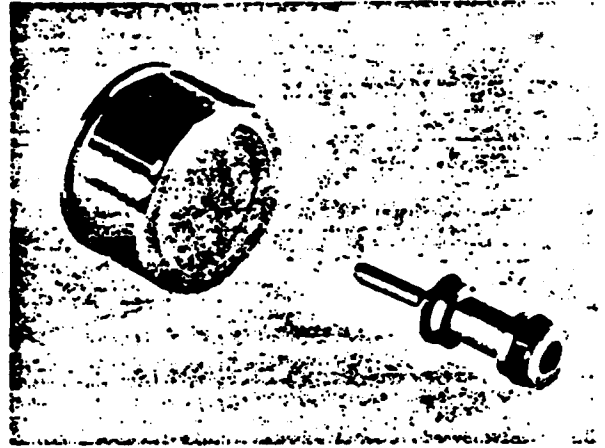


Fig. 8 — Input force at 1" piston is multiplied nine times at 3" wheel cylinder.

HYDRAULIC BRAKES = HYDRAULIC PRESS

Hydraulic brakes work in the same way as the hydraulic press — multiplication of power by a hydraulic lever. (Fig. 8.)

Let's say the master cylinder, which is activated by foot force from the driver, has a piston 1" in diameter. The output piston at the wheel cylinder has a 3" diameter. This gives the system a nine-times mechanical advantage, which means a 50-lb. force at the 1" master cylinder becomes 450 pounds at the 3" wheel cylinder.

4 LIQUIDS IN MOTION

Now that we have an idea of how liquids act in a closed, tightly sealed system, we should take a look at liquids in motion. Here we find quite a different story.

First, we find that there are certain laws which apply to liquids at rest which do not apply to liquids in motion.

For example, the pressure at any level in a standing liquid is the same at all points in the same horizontal plane. But with liquids in mo-

tion, this law does not apply. We shall see that liquids in motion behave very differently.

PRESSURE VARIES WITH SPEED

In Fig. 10, imagine that a liquid is flowing steadily from left to right in the pipe, and that there's a restriction in the pipe — a hole, sometimes referred to as an "orifice."

Because the flow is steady, with just as much coming out as going in, the speed must be greater at the restriction since the area of the pipe



Fig. 9 — The pressure of a standing liquid is the same at all points at the same level.

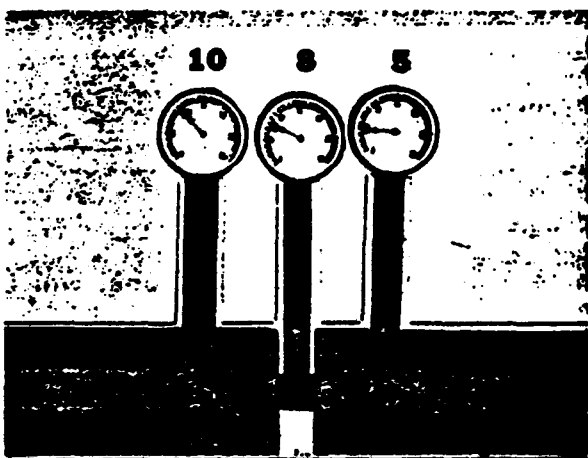


Fig. 10 — Pressures in a flowing liquid change with the speed.

there is less. (You may know this as the "venturi effect," which occurs with air, a type of fluid,

flowing in the restriction of the carburetor throat.) When the steady flow passes the restriction the pressure will rise again. Stated as a rule of physics: "Where the speed is high, the pressure is low; where the speed is low, the pressure is high." This is known as "Bernoulli's Effect."

PASCAL'S LAW TAKES OVER

In Fig. 11, notice that if we were to stop the flow from the outlet entirely, Pascal's Law would take over, and the pressure at all points would be equal to the pressure per square inch at the greatest point.

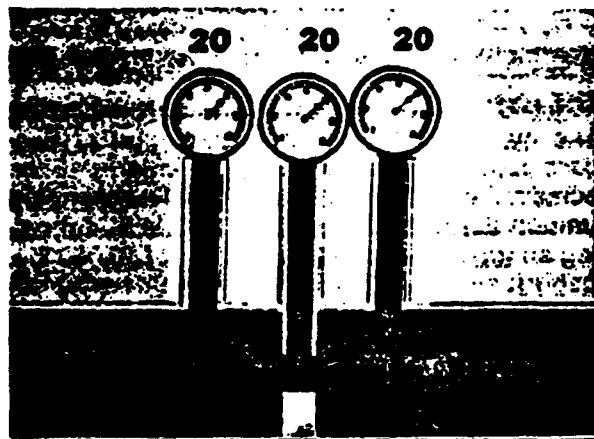


Fig. 11 — With system closed at output, all points have same pressure.

In automotive systems, notably in automatic transmissions and power steering, you'll find many applications of both Pascal's Law and Bernoulli's Effect. Knowledge of these laws will help you to understand the kinds of pressures you'll find in closed and open hydraulic circuits.

5 HYDRAULIC FRICTION

Friction is another factor which has a much greater effect in a hydraulic system than in a mechanical system. For solids, such as a skid pushed along the floor, the friction doesn't change much with a change in speed. But with

liquids, friction resistance goes up rapidly with an increase in flow speed. The amount of friction is also greatly increased by the length of the pipe through which the liquid has to flow. (Fig. 12.)

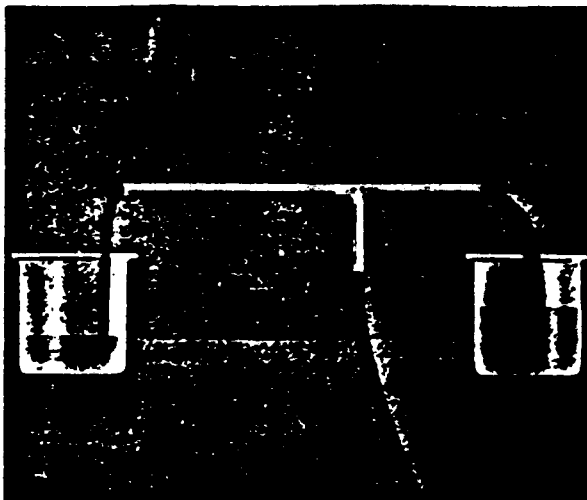


Fig. 12 — Higher friction causes less flow from longer pipe.

VISCOSITY = LIQUID "THICKNESS"

You know that water flows faster than honey. The difference is due to a property of liquids called "viscosity." This property seems to be the result of internal friction within the liquid itself.

VISCOSITY INDEX

A liquid which flows easily has a lower "index of viscosity" than a fluid which flows slowly. Engine oils are the most common example. An S.A.E. 30 (VISCOSITY INDEX) engine oil flows more easily than S.A.E. 40.

Viscosity also changes with temperature, and an oil which might provide a good flow characteristic for lubrication at one temperature might become too "thin" at higher temperatures. For that reason, VISCOSITY STABILITY is a necessity in hydraulic fluids.

For example, hydraulic fluid in an automatic transmission is exposed to wide temperature ranges, and the fluid is usually not changed seasonally. For that reason its viscosity index must be comparable with the multiple-viscosity engine oils.

Multiple-viscosity properties are achieved in an oil by means of "additives" which "stabilize" the desirable qualities over a broad range of operating temperatures.

6

HYDRAULIC VALVES

Valves are inserted in hydraulic lines for two main reasons: to direct or cut off flow from one place to another, and to regulate the amount of flow through a passage. It will help in understanding valve operation if we first decide whether we are looking at a directional valve or a regulator valve.

DIRECTIONAL VALVES

Directional valves, sometimes called "relay" valves, permit flow in one direction. They may be self-operating or manually operated.

CHECK VALVE

A simple check valve is made with a ball and an orifice (Fig. 13). Flow in one direction unseats the ball and allows the flow to continue. But any flow in the reverse direction reseats the ball and restricts the flow.

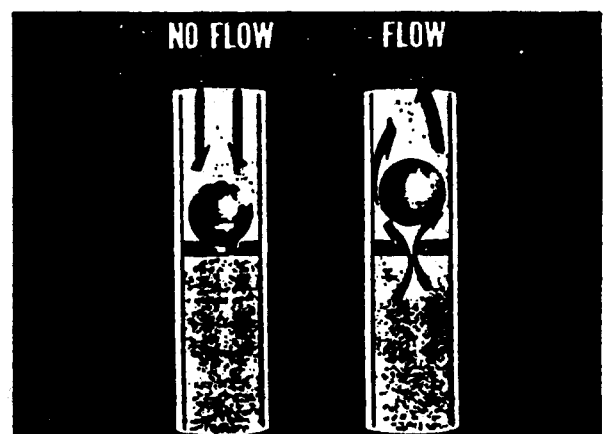


Fig. 13 — Ball check valve.

Flow through a ball check valve may be controlled by spring-loading the ball (Fig. 14).

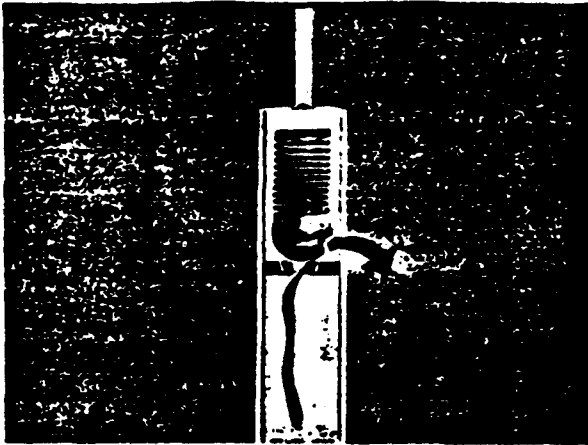


Fig. 14 — Spring loading the ball in a check valve sets the pressure at which valve opens.

For example, a spring may be used which will resist pressures up to a fixed amount — say 100 PSI. This will assure that no fluid passes through the valve at pressures below the value of the spring selected.

By making the spring retainer adjustable, the flow through a valve may be regulated to occur only at the desired pressure. Such a valve is called an adjustable relief valve.

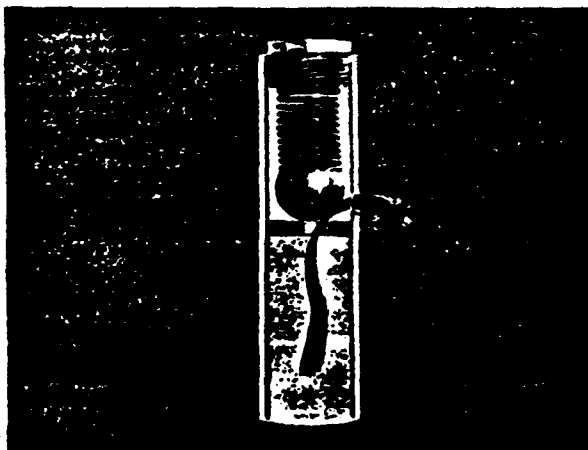


Fig. 15 — When spring tension is made adjustable, the ball check valve becomes an adjustable relief valve.

A typical operation for a relief valve would be a system with a positive displacement pump such as power steering. The belt-driven pump works continuously, supplying a steady flow, even though the system does not use the entire flow at all times. A pressure relief valve in the system

opens and by-passes the excess pump output back to the oil reservoir when the desired pressure has been reached.

A poppet valve is similar to a ball check valve but uses a disc, cone, or other form of stopper to check the flow in the reverse direction.

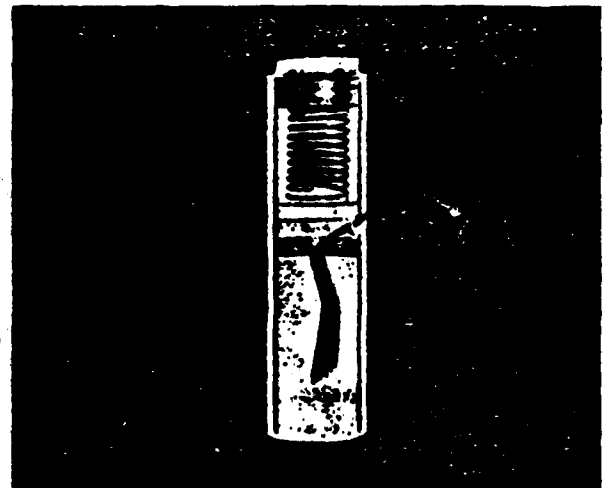


Fig. 16 — Poppet valve uses a disc or other "stopper" to restrict the flow backwards.

Sometimes it is desirable to control liquid flow by means of a manually adjustable valve. A good example is the needle valve used in a hydraulic floor jack. The system pumps up the lifting piston and holds the load steady. To release the load, a needle valve is opened, slowly releasing the fluid back to the reservoir and allowing the jack to retract.



Fig. 17 — A needle valve is usually adjustable by hand.

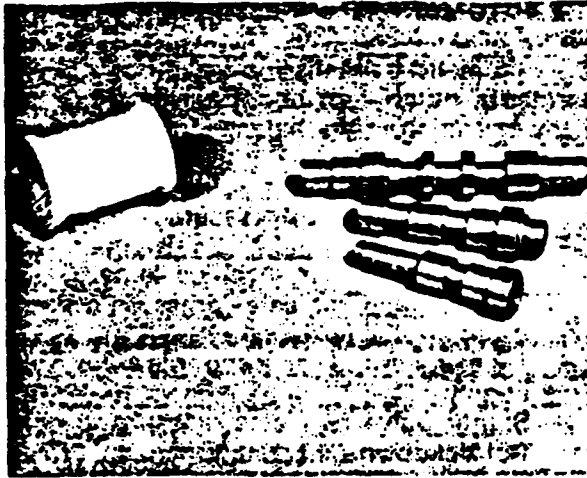


Fig. 18— Spool valves have many uses in automotive hydraulic systems.

SPOOL VALVES

Spool valves are precisely machined, spool-shaped valves that you'll find in a number of places in the automatic transmission and in the power steering mechanism.

POSITIONING SPOOL VALVES

Although spool valves often look very much alike, they actually perform in a number of different ways. For example, the valve may be operated manually, that is, pulled and pushed from one end — the manual valve in the auto-

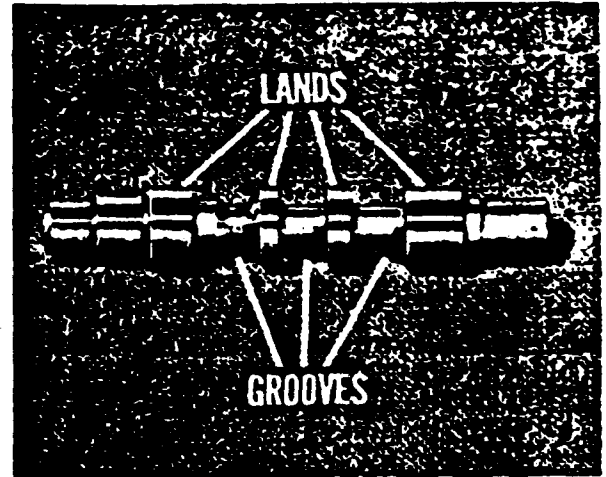


Fig. 19— Spool valve slides on "lands," passes oil at "grooves."

matic transmission control body is an example. The shift quadrant positions determine the valve position.

Another spool valve might move by oil pressure pushing it against a spring with the spring pushing it back again.

A third spool valve might just shuttle back and forth from oil pressure — first on one side, then on the other.

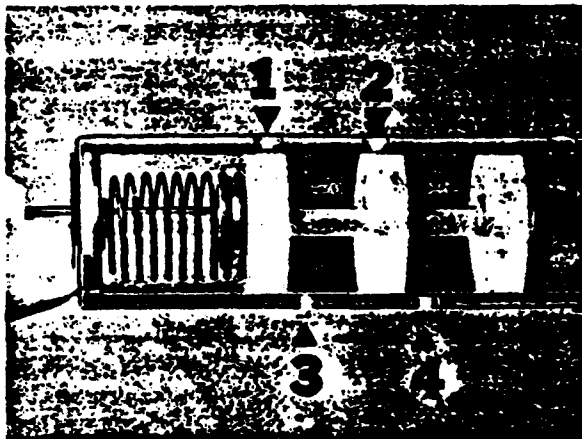


Fig. 20— Oil ports (1) and (2) are blocked by lands, and ports (3) and (4) are supplied with oil pressure. Moving the valve against the spring ...

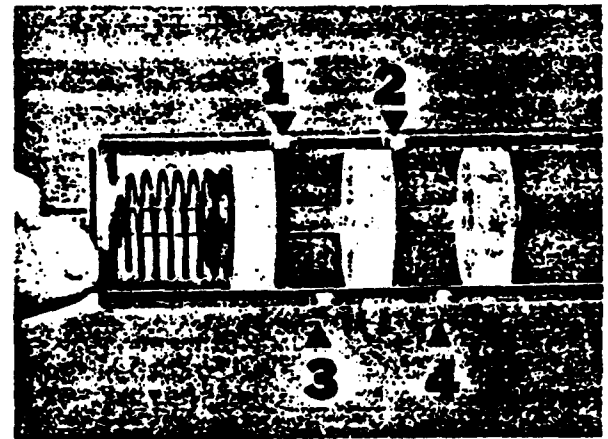


Fig. 21— ... opens ports (1) and (2), allowing simultaneous oil flow across the valve through both ports.

DIFFERENTIAL SPOOL VALVES

As you know from Pascal's Law, the pressure in a closed system is the same on all interior parts of the system. That means if the force is acting upon two movable surfaces, the larger surface will have the greatest reaction.

In Fig. 22, when the force generated by oil pressure through ports (3) and (4) exceeds the spring force, the valve will move in the direction of the larger land and open ports (1) and (2).

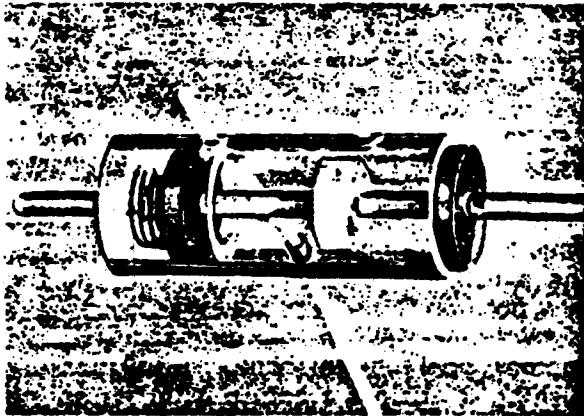


Fig. 22 — Differential spool valve operates from pressure in direction of larger area.

BALANCED VALVES

Also notice that if there is no restriction beyond port (1), the pressure will drop until the force is balanced against the spring load.

In this mode, the spool valve would be acting as a pressure regulator and is called a "balanced valve."

THE AUTOMATIC TRANSMISSION VALVE BODY

The automatic transmission valve body incorporates a number of spool valves (Fig. 23), many operating in the balanced mode to control oil pressures in various circuits.

- Torque converter control valve maintains converter operating pressure
- Main pressure regulating valve maintains the line pressure at specified limits.
- Throttle valve regulates pressure according to throttle position.
- 1-2 shift control valve controls 1-2 upshift quality.
- Shuttle valve regulates pressure to control kickdown shift quality.

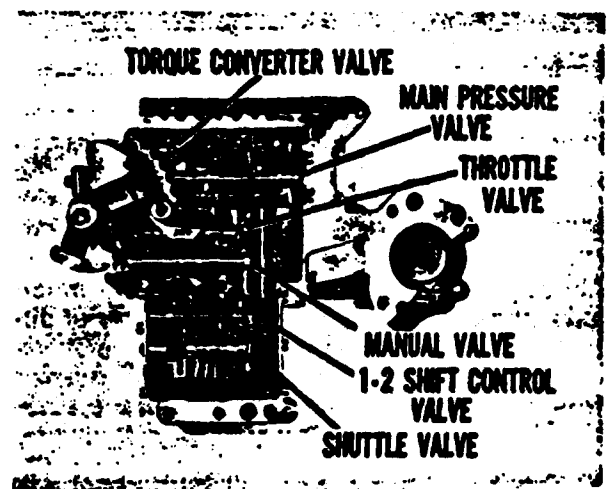


Fig. 23 — Automatic transmission valve body uses spool valves in the "balanced" mode to control circuits, regulate pressure.

7

HYDRAULIC PUMPS

Some hydraulic systems, such as brakes, are operated simply by applying force to one area, then the force is carried through hydraulic lines to the output with very little flow being necessary. This is fine for brakes.

Other systems require a steady flow of hydraulic fluid. The fluid is usually stored in a reservoir or sump and constantly recirculated. For these systems, a positive displacement pump is required.

POSITIVE DISPLACEMENT PUMPS

"Positive displacement" means that the pump will deliver a definite quantity of fluid for each revolution of the pumping member. A pulley-driven power steering pump, for example, delivers a definite quantity of fluid. And since there is more fluid flow at higher speed, the amount needed is controlled by a flow-control valve. And notice that the pump will deliver against pressure no matter how high the pressure. The pump output depends on the speed of the pump rather than the pressure in the system. This is why a relief valve is always required with positive displacement pumps to protect against pressure overloads.

PUMP EFFICIENCY

As pump parts become worn or damaged, fluid can leak between the pumping chambers and cause a loss of efficiency.

Efficiency is the actual pump output with respect to displacement. If a pump has a displacement of 100 cubic inches per revolution but delivers only 80 cubic inches, its efficiency is 80%.

Loss of efficiency doesn't mean pressure is lost, however, because pressure will continue to build up as long as some fluid is being pumped and isn't leaking off somewhere else in the system. But loss of efficiency often does slow down the application of pressure and the movement of working mechanisms.

TYPICAL ROTARY PUMPS

Power steering and automatic transmissions both have positive displacement rotary pumps.

In Fig. 24, the rotor blades or "vanes" follow along the inside of a cam which is wide at one

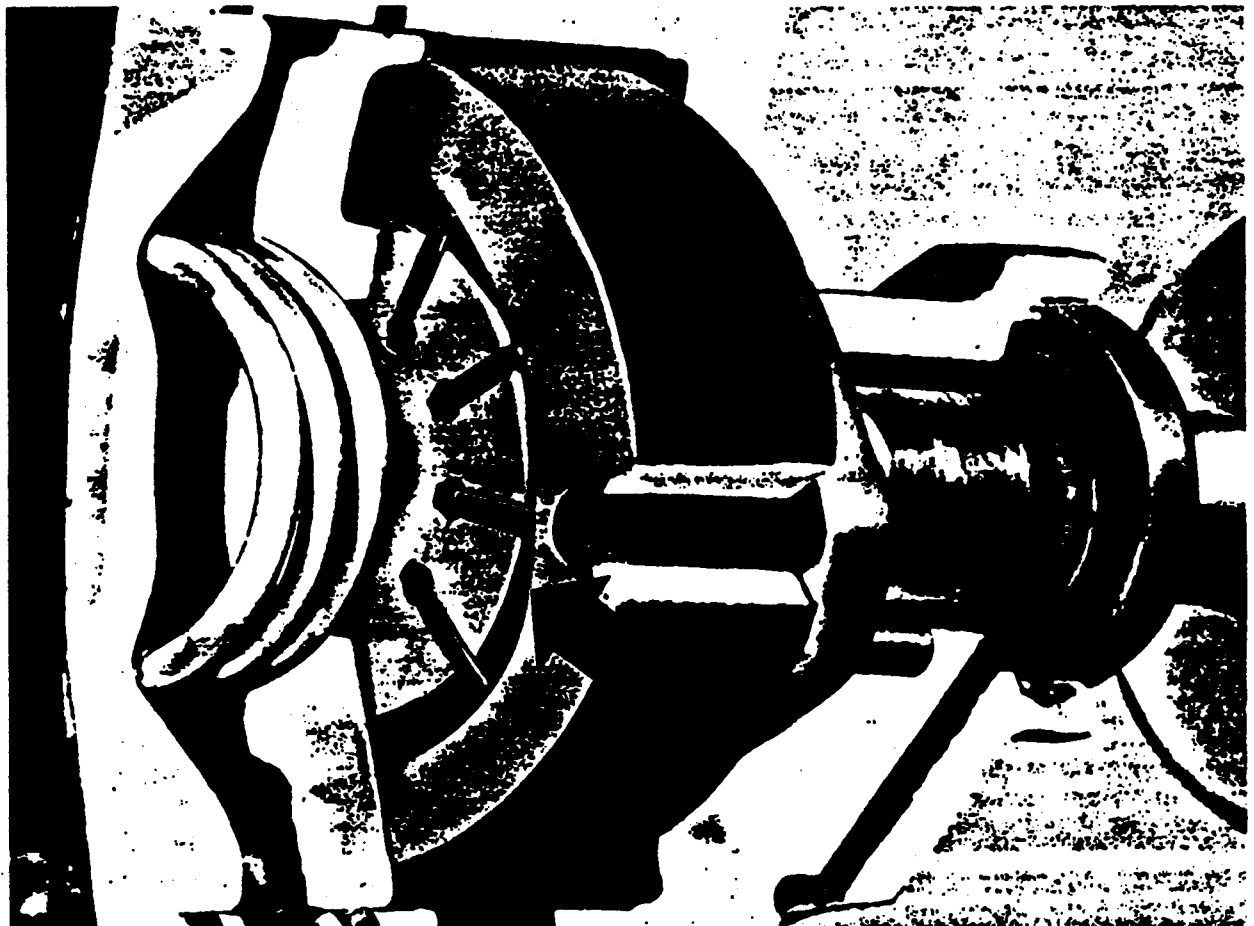


Fig. 24 — Rotor blades sweep oil into narrow chambers...

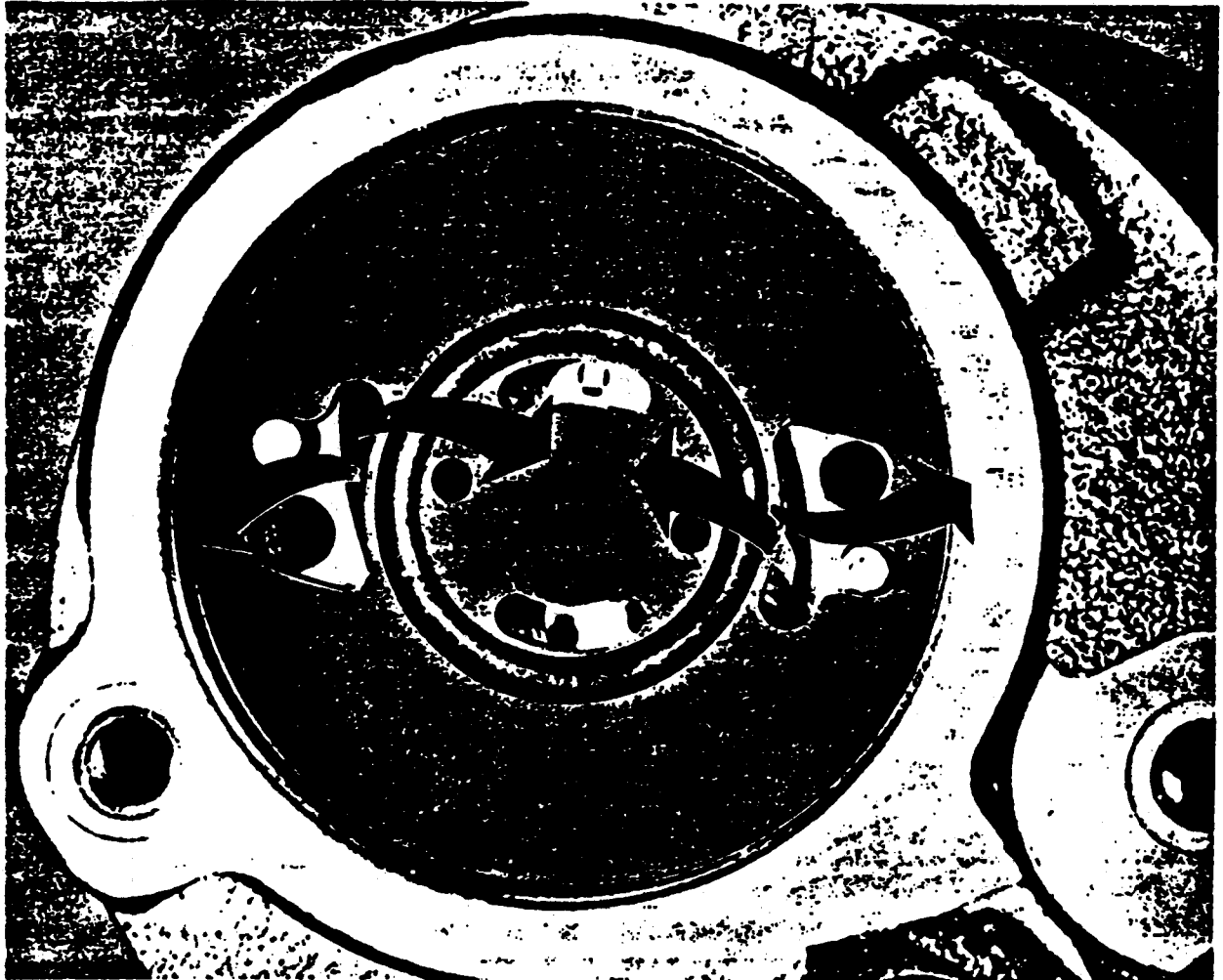


Fig. 25 — ... where it is forced up through a pressure plate to output chamber.

point, then narrows to a very small area. Oil is admitted to the low pressure area (wide space) and is swept by the vanes into the high pressure area (narrow space) where it discharges into the high pressure chamber.

In the automatic transmission oil pump, the rotating cams (Fig. 26) continually pick up oil at low pressure (wide area) and deliver it at high pressure (pinch area) by the same "squeezing" action.

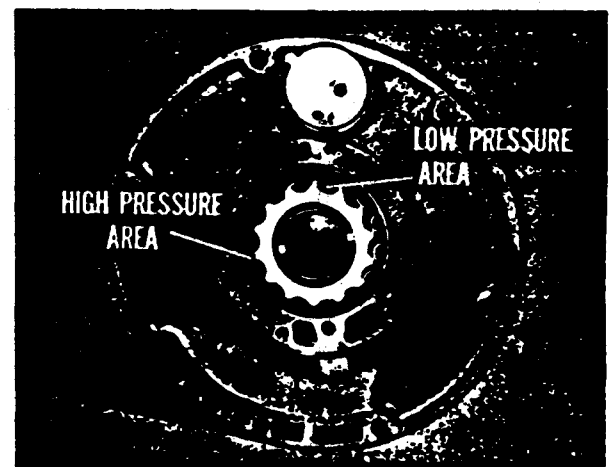


Fig. 26 — Automatic transmission oil pump shows same positive displacement "squeezing" action.

8

HYDRAULIC SEALS

As we have seen, hydraulic systems operate with great power and precision when the system is completely closed and free of air.

Since air is extremely compressible, its presence in a hydraulic system cannot be permitted.



Fig. 27 — Air in a hydraulic system destroys positive action — causes spongy feeling.

SEALS — KEEP OIL IN, AIR OUT.

Obviously, a hydraulic system is no better than its seals. Seals, as well as other rubber parts such as connecting hoses, can swell or shrink, harden or soften, depending on their age, on the composition of the hydraulic fluid and of the seal material, and on the operating temperature.

HYDRAULIC FLUIDS — TAILORED TO THE JOB

Although one hydraulic fluid might look about the same as another, the truth is that hydraulic fluids are not interchangeable.

Just as with engine oils, hydraulic fluids are formulated with specific additives to get just the right characteristics for a particular job — lubrication, oxidation resistance, rust and corrosion resistance, heat resistance, varnish formation resistance, and other qualities. Also, the

fluid must be compatible with the seals in the system so that these can function well for an extended period.



Fig. 28 — Only the hydraulic fluid specified for a system should be used.

For these reasons, only the hydraulic fluid specified for a particular system, should ever be used when topping up or refilling a hydraulic system.

SEALS — POSITIVE OR NOT POSITIVE

An O-ring works just as well one way as it does the other. It seals both ways and is an example of a positive seal. Lip-type seals are also positive and can be used to seal high pressure, but only in one direction.

O-rings are usually made of neoprene (a synthetic rubber) and give long service life if the motion is not too great, in which case friction would tend to wear the seal flat, eventually causing it to leak.

Where motion is great, such as on a rotating shaft or on a fast-moving servo, the oil seal is usually metal for long service life. In this case, the seal is designed to leak a small amount for the purpose of lubrication. With a plentiful supply of fluid, the small leak goes unnoticed in the system's operation. (Fig. 30.)

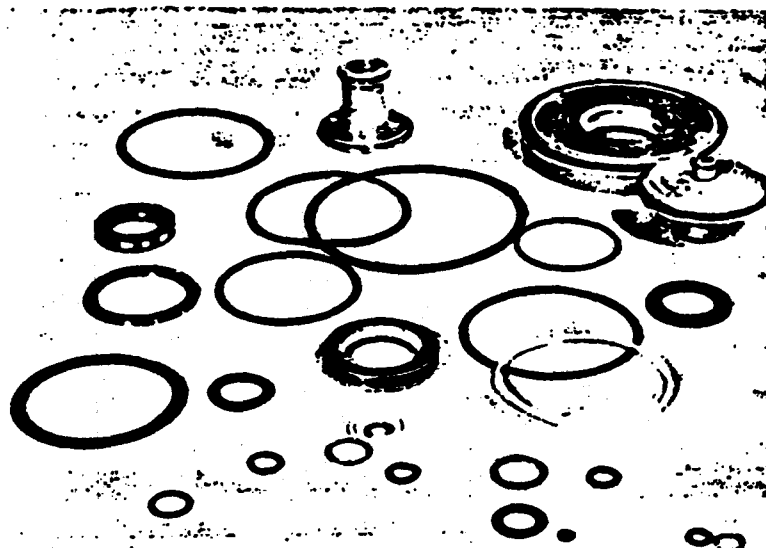


Fig. 29 — O-rings and lip-type seals are positive ...



Fig. 30 — ... metal seal is not positive, since it allows some oil to pass seal for lubrication.

9 HYDRAULIC SYSTEMS — PRECISE, PRACTICAL, LONG-LIVED

Hydraulic systems and circuits provide some of the most precise and useful devices used in industry. And, unlike mechanical systems, hydraulic systems are usually self-lubricating.

Also, modern synthetic hydraulic sealing mate-

rials have extremely high heat and chemical resistance.

Properly maintained, hydraulic systems are among the most reliable, trouble-free, and long lasting in industry.

TEST QUESTIONS

INSTRUCTIONS: The first three questions are multiple-choice type. Circle the letter in front of the statement which you think is correct. For example, if your choice in question number 1 is C, put a circle around it, like this (C). Questions 4 through 10 are TRUE OR FALSE type. Put a mark after TRUE ☒ if you think the statement is correct. Put a mark after FALSE ☒ if you think the statement is incorrect. Be sure to write your name in the space provided. After completing the quiz, turn it in to your Meeting Leader.

1. In a closed, sealed hydraulic system, pressure anywhere in the system...

- A. Builds up by compressing the liquid slightly.
- B. Is transmitted undiminished to all parts of the system.
- C. Varies with the area.

2. A hydraulic lever demonstrates a famous law of physics. What is it?

- A. Bernoulli's Law.
- B. Piston's Law.
- C. Pascal's Law.

3. The pressures in a fluid standing in a bottle are:

- A. The same on every square inch below the surface.
- B. The same everywhere beneath the surface as the air pressure on the surface.
- C. The same at all points at the same level.

4. The pressure in a flowing liquid rises at the restriction or "orifice" in a tube.

TRUE ☐ FALSE ☐

5. A poppet valve is the same as a needle valve.

TRUE ☐ FALSE ☐

6. Spool valves block oil flow with their annular grooves.

TRUE ☐ FALSE ☐

7. A "balanced" spool valve balances internal hydraulic force against an external (reaction) spring.

TRUE ☐ FALSE ☐

8. "Differential" valves have different diameter lands, hence react more in the direction of the larger area land.

TRUE ☐ FALSE ☐

9. A positive displacement rotary pump will deliver fluid no matter how high the pressure builds as long as it continues to turn.

TRUE ☐ FALSE ☐

10. A "positive" hydraulic seal is one which allows a small amount of oil to flow by the seal for lubrication of the surface.

TRUE ☐ FALSE ☐

NAME _____

SUBJECT INDEX FOR 1976

'76 JANUARY "SMOOTH RIDE FACTORS — WHEELS AND TIRES"

Are you sure it's the wheels and tires?
Wheel balance basics
Balancing do's and don'ts
Runout — radial, lateral, loaded
Tire roughness — you can hear it, too
Wheel balancing a finer art

'76 FEBRUARY "SUB-COMPACT MODEL HIGHLIGHTS"

Chassis
Electrical & ignition systems
Engine & cooling systems
Clutch & transmission
Fuel system
Emission controls

'76 MARCH "LOCK CYLINDER SERVICE AND REPAIR"

Serviceability of lock cylinders
How tumbler locks work
Using the code plate
Assembling a lock cylinder
Lock cylinder problems

'76 APRIL "ALIGNMENT SIMPLIFIED"

Alignment or realignment?
Five alignment factors
Pre-alignment inspection
Alignment equipment
Camber and caster adjustments
Steering wheel centering and toe setting

'76 MAY "INSIDE THE ELECTRONIC LEAN BURN SYSTEM"

Component details
Spark advance from the components
Specifications

'76 JUNE "DIAGNOSING ELECTRONIC LEAN BURN PERFORMANCE"

Lean Burn system responds to more variables
Sensors anticipate the need for advanced spark
ELB has advantages during starting, too
Point-to-point testing quickly diagnoses ELB system performance
Failure to start test
Testing for poor performance
Testing for poor fuel economy and high idle speed
Adjusting the throttle position transducer

'76 JULY "ASPEN & VOLARE AIR CONDITIONING — AIR FLOW AND CONTROLS"

Heating and cooling components
Controls
Air flow operation
Vacuum circuits and electrical control circuits

'76 AUGUST "CHECKING A/C COOLING OUTPUT"

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Relative humidity chart
The evaporator and moisture
Checking cooling performance
Checking thermometers and gauges
Compressor changes

'76 SEPTEMBER "NEW PROPANE ASSISTED IDLE ADJUSTMENT"

New labels for 1977 cars
Why a new method?
How propane enrichment works
Propane enrichment procedure
Propane troubleshooting
High-altitude and new engines are different
Step-by-step chart

'76 OCTOBER "POWER STEERING CHECKS AND ADJUSTMENTS"

Are you sure it's the steering gear?
Verifying the customer's complaint
Adjusting the sector shaft
Centering the control valve
Control valve reconditioning
Pressure test
Oil seal replacement
Diagnostic charts

'76 NOVEMBER "TWO BARRELS FOR SIX CYLINDERS"

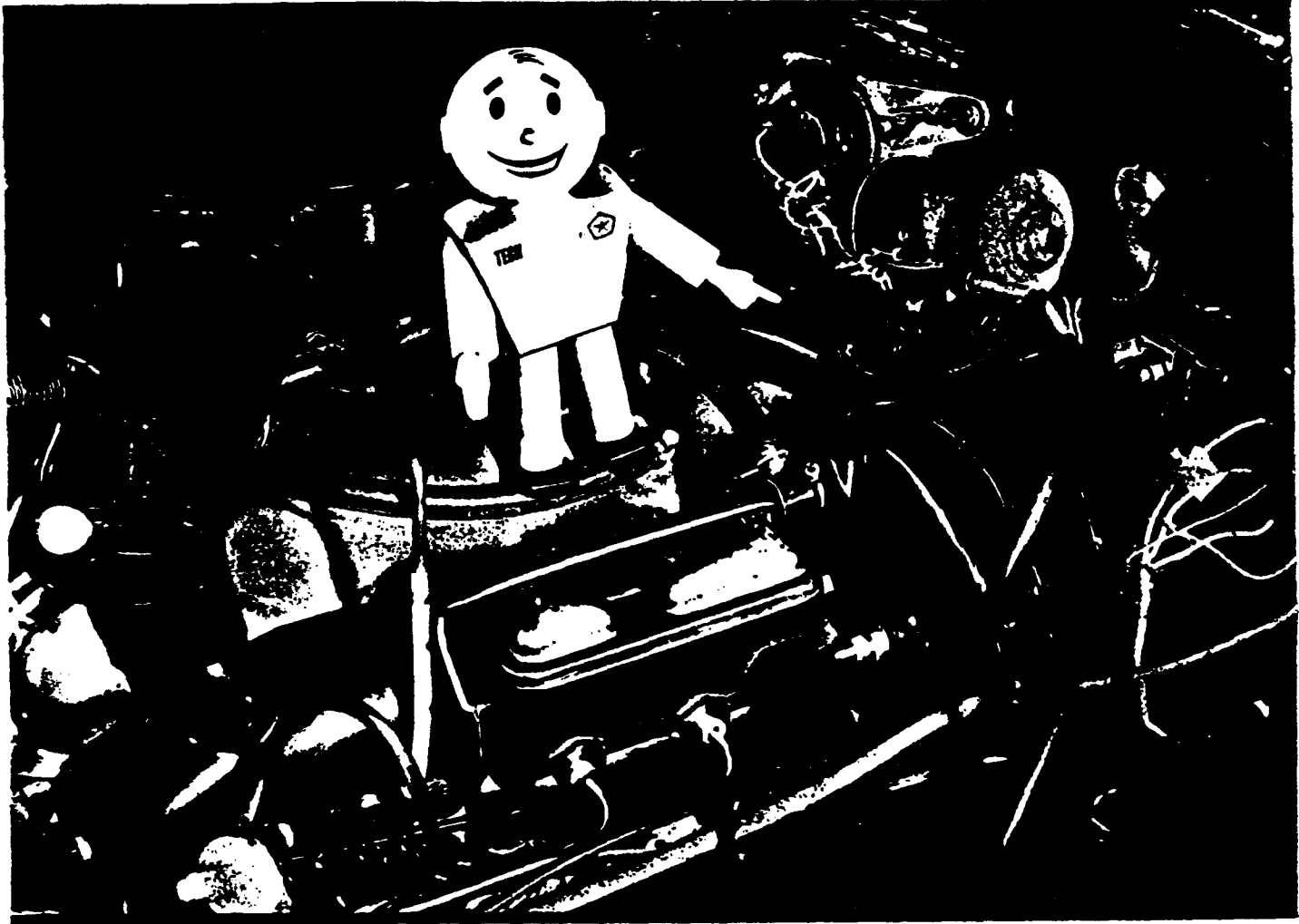
New features
External adjustments
Wet float level setting
Additional carburetor information

'76 DECEMBER "HYDRAULIC FUNDAMENTALS"

Leverage — our "cheapest" way to get power
Liquids — just as strong as steel
Pascal's Law and the hydraulic lever
Liquids in motion
Hydraulic friction
Hydraulic valves
Hydraulic pumps
Hydraulic seals
Hydraulic systems — precise, practical, long-lived.

Master Technicians Service Conference

reference book 75dec



DIAGNOSING POWER BRAKE SYSTEM PERFORMANCE

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Let's talk about the New Brakes



Fig. 1 — Customers question brake system "feel"

THE NEW, SOFTER PEDAL "FEEL"

Almost everyone agrees that brakes on the 1976 models "feel" differently than just a few years ago. No longer do we have a high, hard pedal, especially when the master cylinder is mated to a booster.

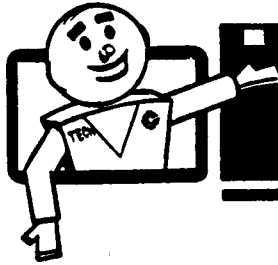
Some customers complain about this new, softer feel, and believe there's something drastically wrong. Generally, these customers are comparing the brake "feel" they experienced on one of their earlier models to that of their new car. Now, we're not saying that things can never go wrong with brake systems. Like anything else on a mass-produced automobile, there's always that possibility. Air may be trapped

in the hydraulic system, or a leak might develop in the system and run the master cylinder dry. The problem is how to distinguish between a malfunctioning brake system and one that is operating normally. It's really not difficult, but you must be prepared.

This training session will supply you and your service technicians with enough good, solid information to prove conclusively, to yourself and to customers, that the "new brake systems" on 1975 and 1976 models are capable of stopping a car safely in all kinds of weather and in all kinds of driving situations. And that the softer brake "feel" is just part of the new brake systems.

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What have engineers done to the Brakes?

DIFFERENT BRAKE PEDAL RATIOS

Over the past few years, brake pedal ratios have inched upward. Not long ago, a three to one ratio of a power brake was considered high. Then the ratio went up to three and one-half to one. And, for 1976, the pedal ratio is four to one on many models.

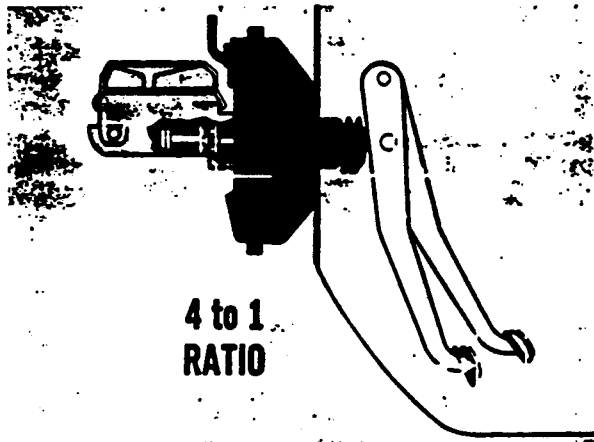


Fig. 2 — Brake pedal ratios have been increased

WHAT PEDAL RATIO MEANS

When engineers talk about pedal ratio, they are referring to the amount of travel of the brake pedal compared to the travel of the input push rod. In the case of a four to one ratio, this simply means that every one inch of input push rod movement requires a full four inches of brake pedal movement. Looking at it in another way, for each one inch of pedal movement, the input push rod moves only one-quarter of an inch. You can readily see that a four to one pedal will produce *more* pedal travel for the same master cylinder piston travel than with a three to one pedal.

LARGER DISC BRAKE CALIPERS

Many of the new 1976 models have new and

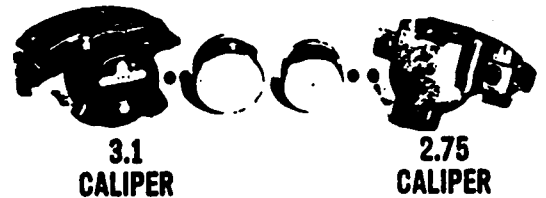


Fig. 3 — Comparison of caliper and piston sizes

larger disc brake calipers with larger diameter pistons. As a result, more fluid is needed to apply the same amount of hydraulic pressure as on prior models.

MASTER CYLINDERS HAVE CHANGED, TOO
Because of the need for more fluid in order to



Fig. 4 — Master cylinders have increased piston stroke

apply the brakes, master cylinder piston stroke has also been increased. This increased stroke supplies the extra fluid needed for the larger diameter caliper pistons.

BOOSTERS ARE BIGGER, MORE POWERFUL
Many of the new 1976 models have bigger,

more powerful boosters as compared to just a few years ago. Some examples include the Valiant and Dart models. They now have a 10-1/2" single-diaphragm booster for their six-cylinder models and a 7-1/2" dual-diaphragm booster on all V-8 models. Last year, the 9" single booster was used.

1976 TANDEM BOOSTER



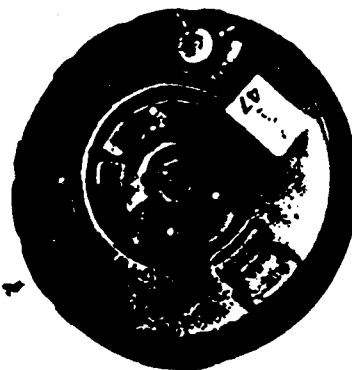
9 1/2"

1976 SINGLE BOOSTER



11 1/2"

SMALLER BOOSTER



10 1/2"

Fig. 5—Larger boosters provide more total assist

All 1976 full-size Plymouth, Dodge, and Chrysler passenger cars built after January 1, 1976, will have the 9-1/2" tandem boosters as compared to the 10-1/2" single booster last year. Naturally, the tandem booster develops a lot more force and thus more hydraulic pressure for the same pedal effort.

BOOSTER COMPARISONS

To illustrate the differences in pressure that the

single diaphragm and the tandem diaphragm can develop, here is an example: Let's say that a force of about forty pounds is applied to the pedal of an older car, using the single-diaphragm booster. With this pedal effort, about *eight hundred pounds* of hydraulic pressure per square inch is sent to the brakes. Now, if this same pedal effort of forty pounds is applied to the tandem booster of a new car, you'll get *eleven hundred pounds* per square inch

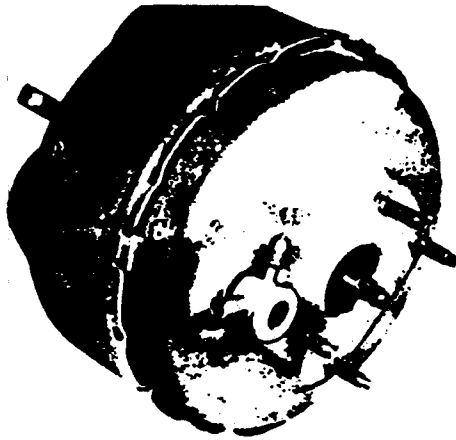


Fig. 6—Tandem boosters are more powerful

pressure. So, it is easy to see that with the bigger boosters, more fluid is pushed out to the brakes in comparison to older models with smaller boosters. Again, this means more pedal travel . . . another factor in the increased stroke of the brake pedal and softer "feel" of the brakes on 1976 models.

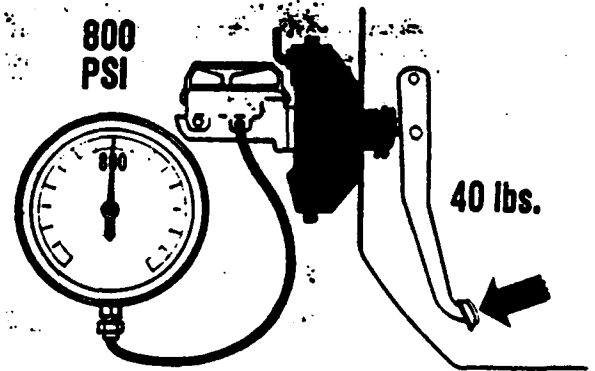
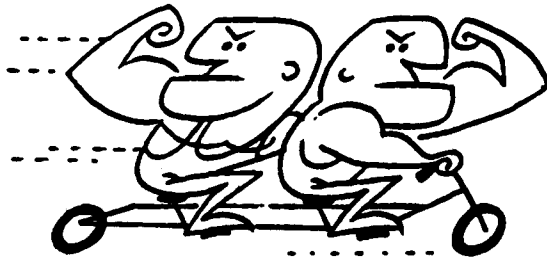


Fig. 7—Single diaphragm boosters

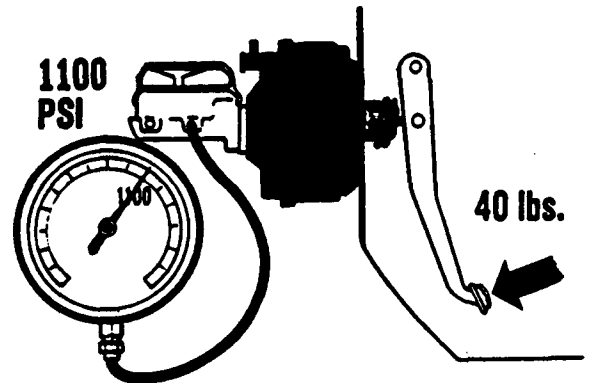
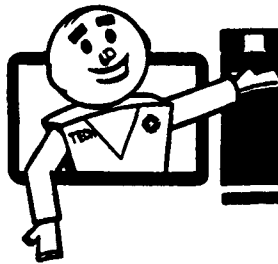


Fig. 8—Tandem boosters develop greater pressures



Let's talk about Boosters

BOOSTER RUNOUT

When all of the power assist from the booster has been used, this is called *booster runout* . . . also called the *maximum assist point*. When this condition occurs, the pedal becomes very firm and if the car isn't moving, many drivers think the pedal goes right down to the floor. That's just not true, as you will soon see.

HOW MUCH PEDAL EFFORT?

On today's new models, it only takes about forty pounds of pedal effort to reach booster runout. In most cases, the newer models can be brought to a screeching halt way before the booster has reached runout. Yet, customers often attempt to use brake "feel" when a car is stopped to judge how well the brakes work. This is not a good test. You might as well try to compare apples and oranges.

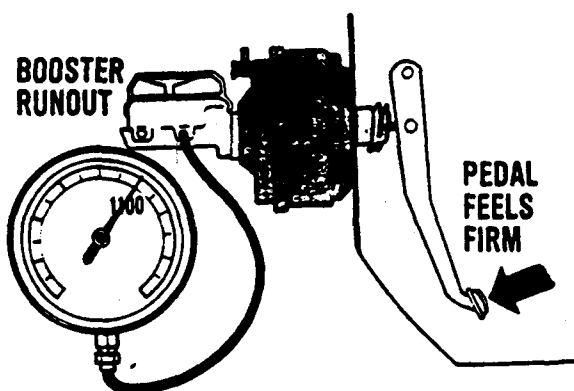


Fig. 9—Booster runout reached with little effort

MORE BRAKING AVAILABLE

When the booster has reached the condition called booster runout, it does *not* mean that there is no additional braking available. Far from it. All the driver has to do is push harder on the pedal. That is, by applying greater effort than prior to booster runout.

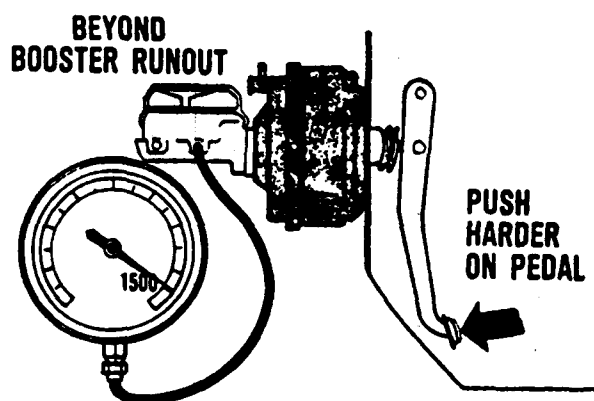


Fig. 10—There's more braking after booster runout

To prove that more braking is available to the customer, follow this simple demonstration:

PROVING PEDAL RESERVE

If possible, have the customer get in the driver's seat so that he can experience the "proof of

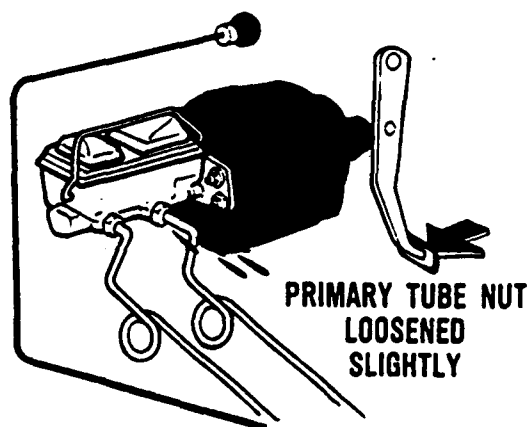


Fig. 11—Controlled leakage demonstrates pedal reserve

reserve" in his car's braking system. Here's what to do: With the engine running, have the customer apply and hold moderate to heavy effort on the pedal. Then carefully crack the primary system tube nut at the master cylinder (brake line feeding the front disc brakes).

NOTE: Shop cloths are needed to absorb escaping fluid.

As the customer maintains pedal effort, hydraulic fluid will escape until the primary piston bottoms in the master cylinder. Have him hold the pedal down all the way and keep it there until you signal him to release it. During the controlled fluid leakage, the customer will find that the pedal will travel anywhere from one



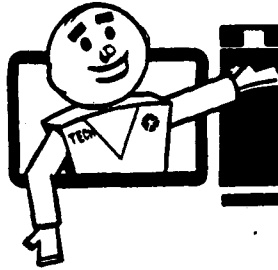
Fig. 12—Tighten tube nut after "proof of pedal reserve"

and one-half inches to as much as two inches beyond the point he believes it to be floorboarding!

WARNING LIGHT COMES ON

During this demonstration, the warning light will come on and stay on since hydraulic pressure has been lost in half of the system. Tighten the tube nut snugly, then signal the customer to

release the pedal. Replace hydraulic fluid lost in the primary reservoir and reinstall the cover. To turn the warning light off, have the customer reapply pedal effort. As you well know, equal hydraulic pressures within the dual brake system will turn the warning light off as the switch piston in the control valve assembly automatically resets.



Proving Booster Performance

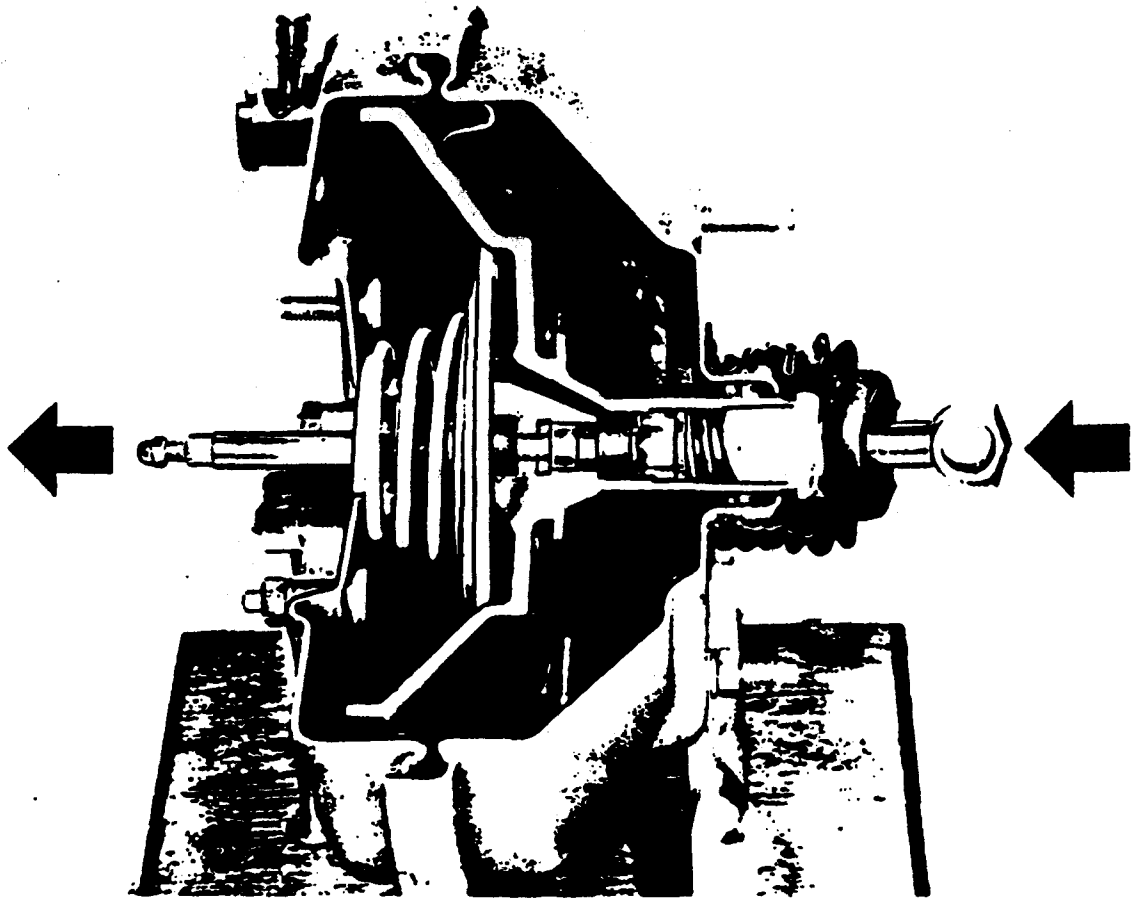


Fig. 13 — Boosters are the solid, straight-through design

LET'S LOOK AT BOOSTER DESIGN

All boosters used in Chrysler Corporation passenger cars and light trucks are the in-line design. When you push on the pedal, there is only about one-tenth of an inch of booster travel needed to operate the booster valves. From that point on the booster is *solid straight through*.

As you can see, there is no way that you can lose travel in one of our boosters and cause a low pedal . . . even if the booster happens to be defective. In other words, a booster cannot cause a spongy pedal even if it happens to go bad.

IMPORTANCE OF GOOD VACUUM SUPPLY

If you run into a customer complaint of poor brakes such as "pedal goes to floor," it may be caused by a booster not getting enough vacuum. The customer believes the pedal is down to the floor because pedal "feel" becomes very firm. With low vacuum, the driver may be reaching booster runout as he makes repeated brake applications in heavy traffic situations.

NEED FOR ENGINES TO BE IN SHARP TUNE

Just as an example, let's say that a properly tuned engine can produce sixteen inches of vacuum at moderate driving speeds. Now, because of poor engine tune, let's assume that only *half* of the vacuum is available for power assist. In effect, this means that only *half* of the power booster is available. So, you can readily

HALF THE VACUUM

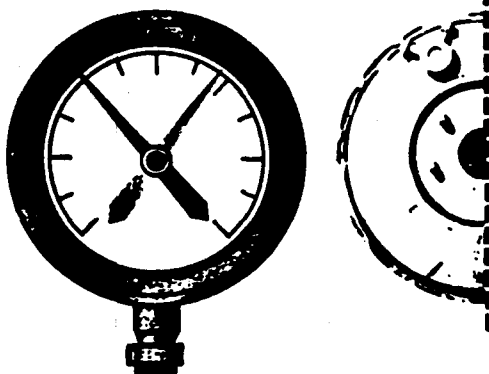


Fig. 14 - Half the vacuum available - half the booster assist

see that engines must be kept maintained in sharp tune. One thing to keep in mind is the fact that some of the changes made to meet strict emission control standards have caused today's engines to develop a lower level of vacuum in comparison to some older models.

CHECK THE VACUUM SUPPLY

Poor vacuum at the booster may also be caused by a pinched or kinked vacuum supply hose. Be sure it is routed properly with no sharp bends. To check the vacuum level at the booster, take a vacuum reading by attaching a gauge to the speed control fitting which is part of the booster check valve.

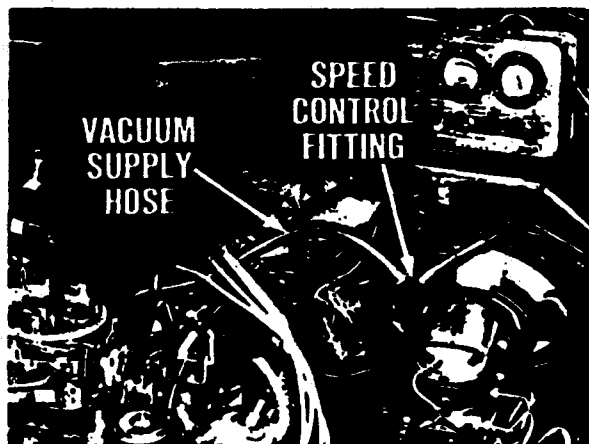


Fig. 15 - Vacuum test at the booster check valve

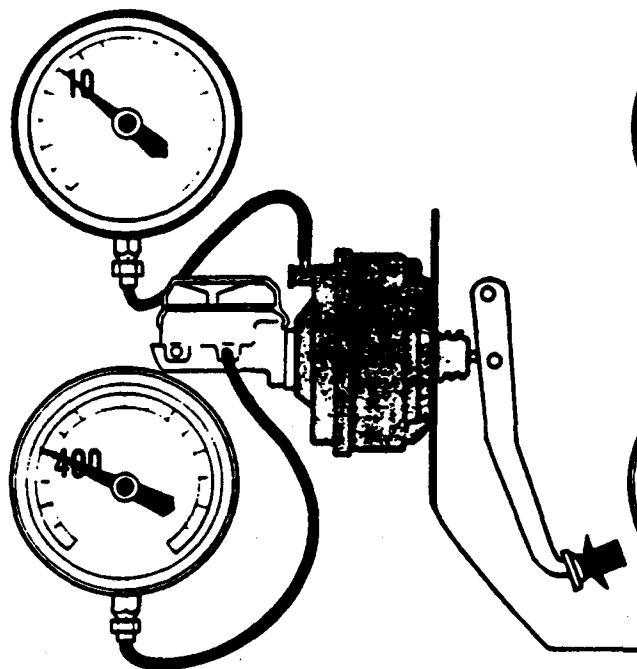
VACUUM LEVEL

There are some misconceptions about the level of vacuum at the booster and its effect on booster performance. Frankly, the level of vacuum has *absolutely no effect* on booster performance **BEFORE** the booster runout point. High or low vacuum just raises or lowers the booster runout point. In other words, twice the vacuum . . . twice the runout.

MILEAGE AND SOFT PEDAL

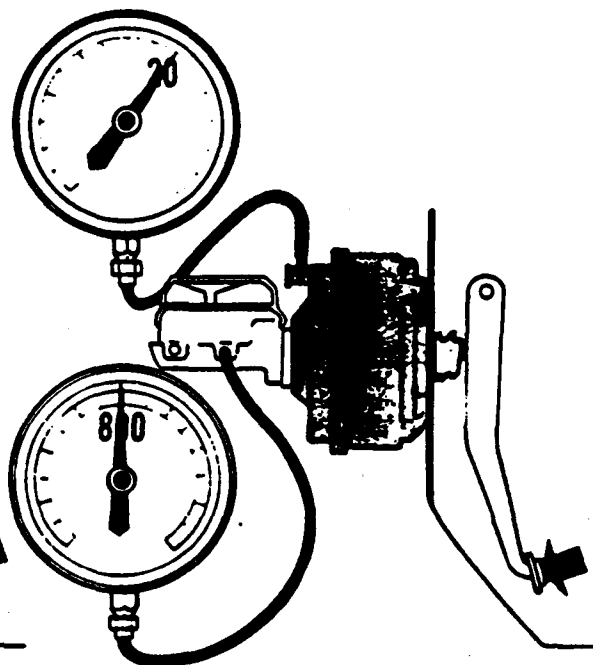
Some reported cases of an extremely soft brake pedal "feel" have been directly attributed to rear brake linings not fully "bedded" to the drums because of very low car mileage. In such instances, the brakes will get better (pedal "feel" improved) as mileage increases. One other thought: Some customers change the

10" VACUUM



400 PSI

20" VACUUM



800 PSI

Fig. 16 — Twice the vacuum . . . twice the runout

car's direction from backing up to a forward motion by shifting from reverse to drive range **WITHOUT** stepping on the brake pedal or if they do apply the brakes, it is only a gentle tap and not firm enough to permit the automatic rear brake adjusters to function.

If you feel that excessive clearance between the linings and the drum is partially responsible for a low, soft pedal, then it is suggested that you take the car out on a lightly travelled road and while moving in reverse, apply the foot brakes firmly. Repeat this action at least six to eight times in order to assure yourself that the linings are properly adjusted.

REPLACE THE BOOSTER?

One big point we'd like to make right now is

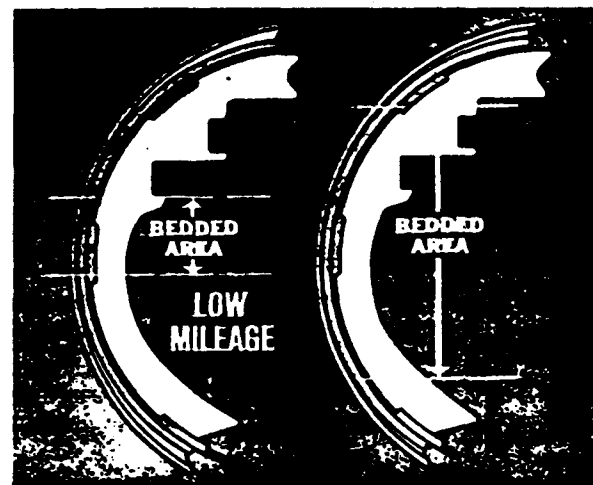


Fig. 17 — Bedded area of linings increases with mileage

THERE'S JUST NO WAY THAT YOU CAN FIX A LOW PEDAL BY A BOOSTER EXCHANGE!

Fig. 18—An important point to remember

that replacing the booster is not the answer for correcting a low pedal condition.

There's just no way that you can fix a low pedal by a booster exchange! Keep that thought in mind as you go through your checking of brake system components.

BOOSTER OUTPUT PUSH ROD

The booster output push rod has a small acorn-shaped tip that fits into a recess in the primary piston of the master cylinder. This small tip *should never be adjusted* to decrease or increase the overall length of the push rod.

This overall dimension of the push rod is calibrated and set at the factory with special preci-



Fig. 19—Never attempt adjustment of output push rod

sion equipment. There is no way the output push rod length can have a significant effect on pedal travel.

CHECKING BOOSTER OPERATION

There are three quick checks you can make on the car to determine if the booster is operating normally: a booster function check . . . a check for an unapplied vacuum leak . . . and an applied vacuum leak check. None of these checks requires a gauge or any special tool.

BOOSTER FUNCTION CHECK

To make this test (engine off), step on the brake pedal at least four or five times to exhaust all the vacuum reserve in the booster. Now, with moderate effort applied to the brake pedal, start the engine. As the vacuum level rises, the pedal will seem to pull down from under your foot if the booster is operating properly. If it does not, repeat the test to make sure of your diagnosis.

MAKING AN UNAPPLIED LEAKAGE TEST

If the booster function checks out okay, let the engine run for a short time, then turn it off. Without touching the brake pedal, wait at least two or more minutes before making *one* brake application. Apply moderate effort on the brake pedal. You should feel power assist. If you get no assist, the booster has an unapplied vacuum leak and should be replaced.

NOTE: Any vacuum leakage in the booster will exhaust the vacuum reserve inside the booster shell within two minutes, thus preventing any booster assist.

MAKING AN APPLIED LEAKAGE TEST

If you found the booster normal in the previous tests, then run the engine at a slow curb idle speed. With the windows rolled up and the car doors closed, step on the brake pedal. If the engine starts to run rough or you hear a *loud, continuous hissing sound* this indicates the booster has an applied vacuum leak condition and must be replaced.

By the way, don't mistake normal booster "breathing" when the pedal is moved for a vacuum leak.

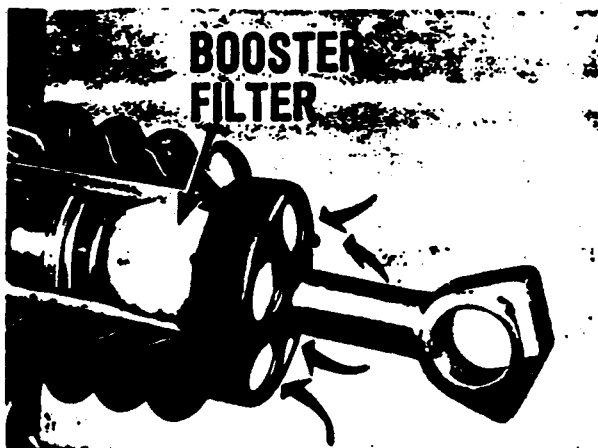
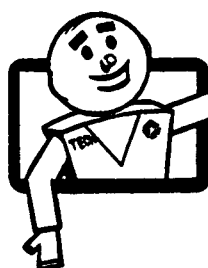


Fig. 20 — Air filtered before entering booster

NOTE: Boosters have a filter inside the synthetic rubber boot. When the input push rod closes the vacuum valve and opens the rear section of the booster to atmosphere, the air rushing through the filter into the booster causes a slight "breathing" sound and is normal.

BOOSTER CHECK VALVE

There is no check valve problem that could affect booster operation when the engine is running. Changing a check valve is just a waste of time unless it has received physical damage!



Tips on reading the Brake Warning Light

Being able to "read" the brake warning light is one of the best diagnostic tools available. Let's review how it can be used in brake system diagnosis.

TESTING WARNING LIGHT CIRCUIT

To begin with, turn the ignition switch to the Run position. Then, apply the parking brake. The warning light should come on. If it does, then you know that the bulb, the wiring circuit, and the fuses are all okay. If it does not, repair is necessary. Release the parking brake and start the engine.

CHECKING FOR TRAPPED AIR

Apply the brakes slowly, then gradually begin to increase the pedal effort. If the warning light flashes on *before* you've reached heavy effort on the pedal, then you know that there's a *large* amount of trapped air in the brake hydraulic system. On the other hand, if it takes *very heavy pedal effort* to turn the warning light on, then this indicates that only a *small* amount of trapped air is present in the brake system. In either

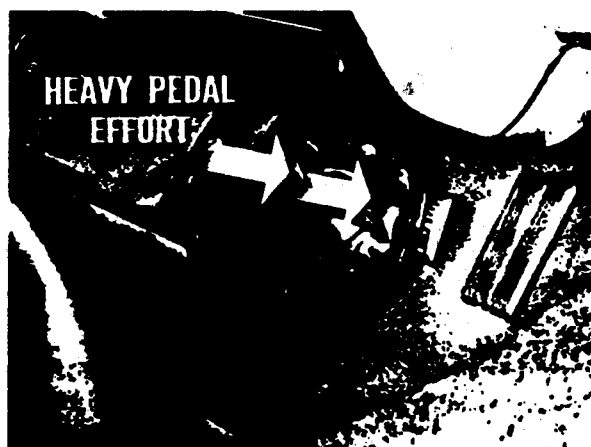


Fig. 21 — Checking for trapped air in hydraulic system

case, when pedal effort is released, the warning light will go off, even though all 1976 brake warning light switches are the "latching" type. Remember, all disc brake cars as far back as 1972 have a "latching" type of brake warning light switch except the Valiant and Dart models. The non-latching-type will go out as soon as you take your foot off the brake pedal.

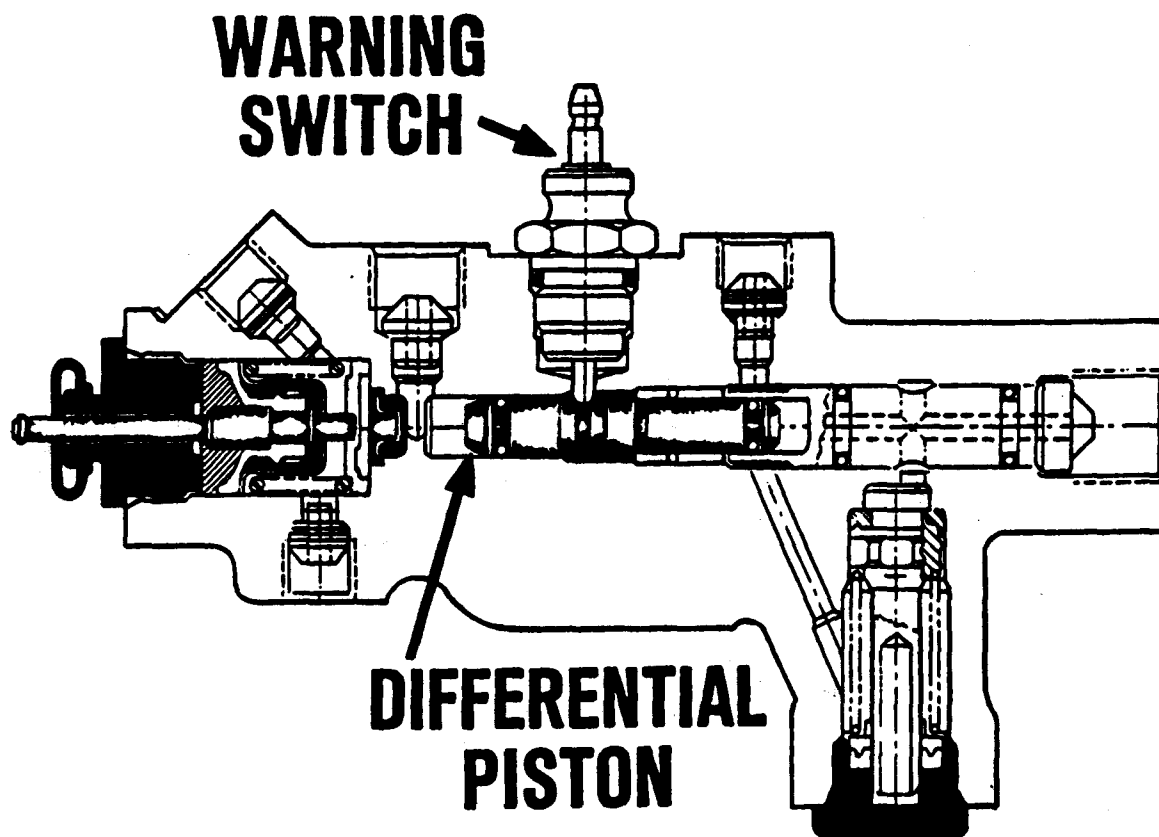


Fig. 22 — Typical "latching" type brake warning switch

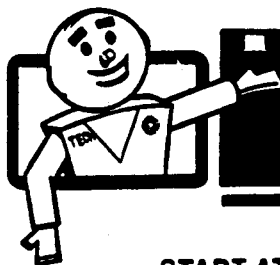
WARNING LIGHT DOESN'T STAY ON

If you have air trapped in either side of the brake system, a latching type warning switch will turn the light on when you apply the brakes and the light will go off when you take your foot off the brake pedal. But, if you have a defective master cylinder or hydraulic leakage in the system, then the latching type warning switch will come on and stay on.

If you can't get the warning light to come on and stay on (cars with a "latching" type warning switch), you do not have a defective master cylinder.

**YOU DO NOT HAVE A
DEFECTIVE MASTER CYLINDER
IF YOU CAN'T GET THE
WARNING LIGHT TO COME
ON AND STAY ON AFTER
RELEASING PEDAL EFFORT!
(WITH LATCHING TYPE WARNING SWITCH)**

Fig. 23 — Keep this in mind during your diagnosis



Bleeding the Hydraulic System

START AT THE MASTER CYLINDER

If one of the reservoirs in the master cylinder is found to be dry because of a leak somewhere in the hydraulic system, then you know the system has "gulped" a large amount of air. In such a case, it is far easier and quicker to bleed the air out of the master cylinder before attempting to bleed it out at the wheels. For another thing, it saves on hydraulic fluid. This method is also recommended whenever a new or overhauled master cylinder (dry) is installed.

USING THE SPECIAL BLEEDING TUBES

You'll need two special bleeding tubes that have a residual check valve attached to the ends of the tubes. These residual check valves are simply small synthetic rubber caps having a small slit that remains closed until fluid pressure forces it open. When pressure is released, the slit closes.

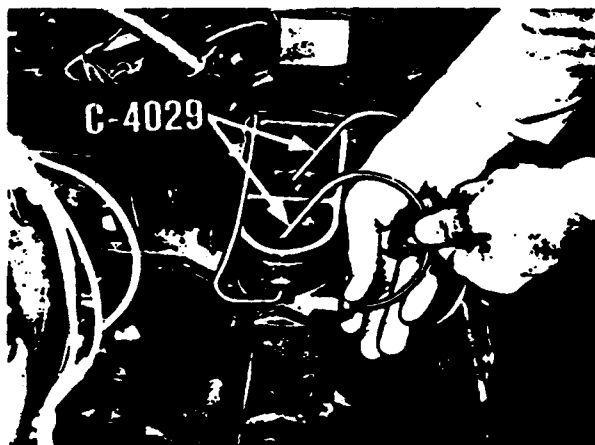
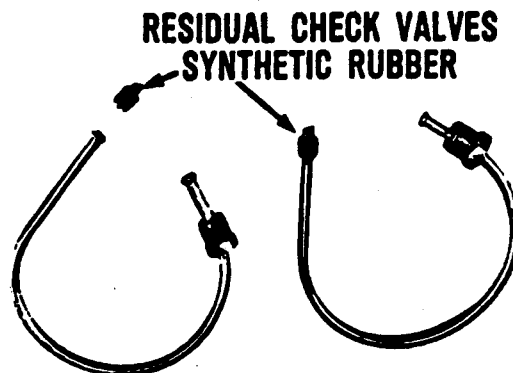


Fig. 24 — Installing special bleeder tubes

TWO RESIDUAL CHECK VALVES NEEDED

If your special bleeder tubes are equipped with only one check valve, then it is suggested that you order one more. Request Part No. SP 5195 for the separate residual check valve.



SPECIAL BLEEDER TUBES

Fig. 25 — Two residual check valves needed

NOTE:

The bleeder tubes, C 4029, are shipped with only one check valve although two are needed when bleeding the master cylinder on all 1974, 1975 and 1976 passenger cars and light trucks.

The following information will explain why.

Beginning with the introduction of the 1974 passenger car and right up to the present 1976 model year, residual check valves in the master cylinder primary and secondary outlet ports were discontinued on all models equipped with drum brakes front and rear. On models with front disc/rear drum brakes, the check valve in the rear half of the system (secondary) was also discontinued.

HERE'S THE REASON

Engineers were able to do away with residual check valves by adding cup expanders to the inside of the wheel cylinder piston cups. These expanders apply a slight pressure against the seal lips holding them tight to the wheel cylinder bore. Thus, when the brakes are released and the wheel cylinder pistons retract, the pos-

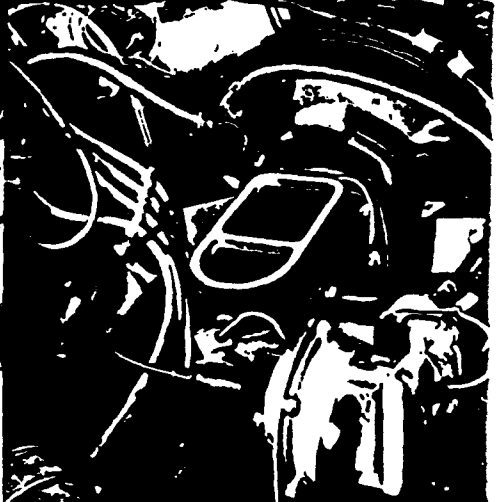
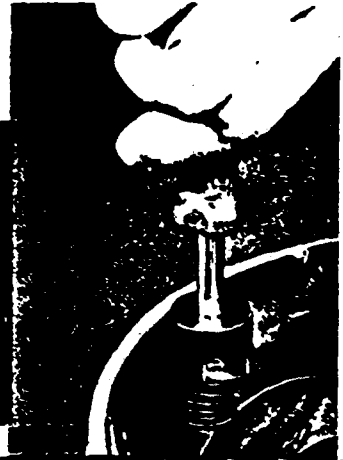
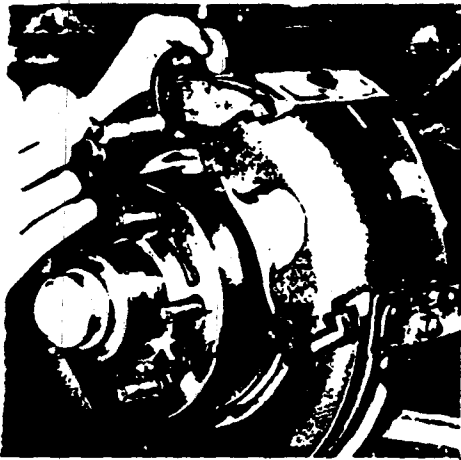
Test Questions

INSTRUCTIONS: The first three questions are multiple-choice type. Circle the letter in front of the statement which you think is correct. For example, if your choice in question number 1 is C, put a circle around it like this: **©**. Questions 4 through 10 are TRUE or FALSE type. Put a mark after TRUE **X** if you think the statement is correct. Put a mark after FALSE **X** if you think the statement is incorrect. Be sure to write your name in the space provided. After completing your quiz, turn it in to your Meeting Leader.

1. If a customer complains because he feels his brake pedal is "going to the floor" and there is no brake warning light, the first thing to look for is:
(A) A bad master cylinder.
(B) A low booster vacuum supply.
(C) A leaking brake line fitting.
2. It takes more hydraulic fluid to apply the same brake pressure in 1976 passenger cars than earlier models because of:
(A) The larger size of the combination valve assembly.
(B) The larger booster.
(C) The larger diameter caliper pistons.
3. When the driver pushes on the brake pedal, there is some booster travel needed to operate the booster valves BEFORE the booster begins to move the master cylinder. Would you say that this booster travel amounts to about:
(A) One-half of an inch?
(B) One-tenth of an inch?
(C) One inch?
4. Although tandem boosters have smaller outer diameters than the single-diaphragm type, they develop a lot more force and thus more hydraulic pressure for the same pedal effort.
TRUE ☐ FALSE ☐
5. If you have a spongy brake pedal on a power brake car, the first thing to look for is an un-applied vacuum leak.
TRUE ☐ FALSE ☐
6. When the booster has reached booster run-out, there is no more braking available.
TRUE ☐ FALSE ☐
7. Because of our booster design, there are at least two ways it can cause a low pedal.
TRUE ☐ FALSE ☐
8. If it takes very heavy pedal effort to turn the brake warning light on (car has a "latching" type warning switch), and the light goes out when you release the brake pedal, then you know the master cylinder is bad.
TRUE ☐ FALSE ☐
9. If the master cylinder is "dry", it is far better to get all the air out of the system by doing all the bleeding at the brakes.
TRUE ☐ FALSE ☐
10. During the bleeding operation, remember that trapped air in the brake lines far upstream from the bleeder screw is more easily expelled by a slow fluid discharge.
TRUE ☐ FALSE ☐

NAME _____

AUGUST 1977



BRAKE SYSTEM DIAGNOSIS HIGHLIGHTS



SERVICE & PARTS DIVISION



CHRYSLER
CORPORATION

SOLVING BRAKE PROBLEMS = PROPER DIAGNOSIS...

At one time or another, we've all had the uncomfortable experience of trying to stop a car with brakes that weren't up to par. So we know how important it is to properly diagnose and correct even seemingly minor brake problems for our customers' safety and peace of mind.

Proper diagnosis of brake problems depends on more than just having a good working knowledge of how each brake system component operates. It also hinges on the ability to relate symptoms of poor brake performance with faulty component operation.

Properly interpreting a customer's complaint is important, too — but this can be tough at times.

Let's say a customer drives in with a "spongy brake" complaint. You might find that the excessive brake pedal travel or sponginess is caused by air trapped in the hydraulic lines or

by another problem in the brake system. But maybe the customer is simply unfamiliar with the softer brake pedal "feel" on most recent Chrysler Corporation passenger cars, compared to the harder pedal feel on models of previous years.

To help you interpret any future brake pedal "feel" complaints, this MTSC session will cover brake system improvements which resulted in a softer pedal feel as well as provide information on how to diagnose an actual spongy brake condition. This session will also help you to identify and eliminate the causes of brake roughness and vibration, brake drag, front brake pull and rear brake lockup.

In addition, this session will provide information on how to deal with chirps, thunks, rattles, squeaks and other noises originating from somewhere in the brake system.

CONTENTS	PAGE
SOFTER PEDAL FEEL VS. "SPONGY" BRAKES ...	1
ROUGHNESS AND VIBRATION	6
BRAKE DRAG	9
FRONT BRAKE PULL	10
REAR BRAKE LOCKUP	11
NOISES	11

1 SOFTER PEDAL FEEL VS. "SPONGY" BRAKES

To give you some idea why customers can mistake a well-operating brake system for spongy brakes, we'll first discuss the reasons behind the softer brake pedal feel on most recent Chrysler Corporation passenger cars.

4 to 1 PEDAL RATIO = SOFTER PEDAL FEEL

Recent brake pedal linkage improvements have increased the pedal ratio to 4 to 1, allowing the driver to generate more hydraulic pressure with the same pedal effort.

A 4-to-1 ratio means that the brake pedal moves four inches to push the master cylinder piston forward by one inch.

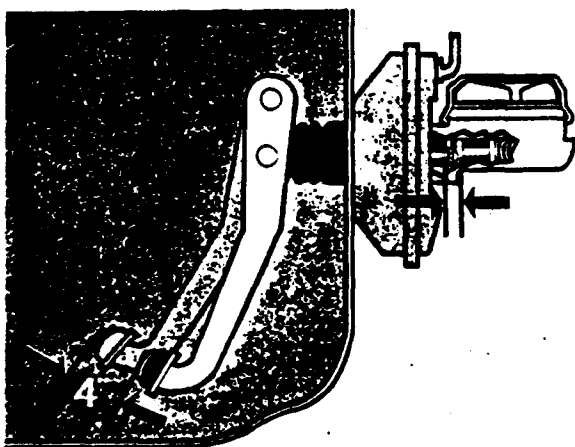


Fig. 1 — Most pedals now have a 4 to 1 ratio.

On earlier models, pedal ratios were 3 and 3½ to 1. The brake pedal moved only three or three-and-a-half inches for every inch of master cylinder piston travel.

So the larger 4-to-1 ratio increases the distance the brake pedal must travel to produce the same amount of master cylinder piston movement. This longer pedal travel produces a softer feel which some customers mistake for a spongy brake condition.

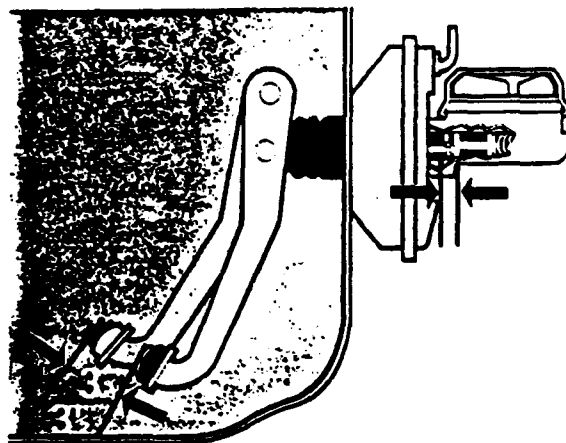


Fig. 2 — Pedal ratios previously were 3 and 3½ to 1.

BOTTOMING-OUT FEEL

Besides mistaking the new longer pedal travel for a spongy brake, some customers also confuse the hard pedal feel which occurs at booster runout with the bottoming-out of the brake pedal due to a defective brake condition.

Let's say a power brake booster reaches its runout point or its maximum assist at an hydraulic pressure of about 900 pounds per

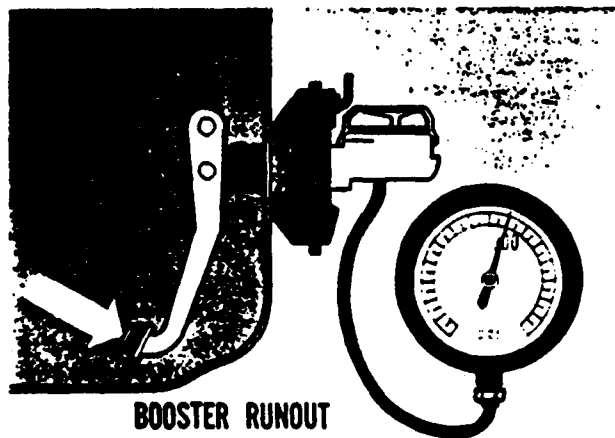


Fig. 3 — Pedal effort is easy up to booster runout.

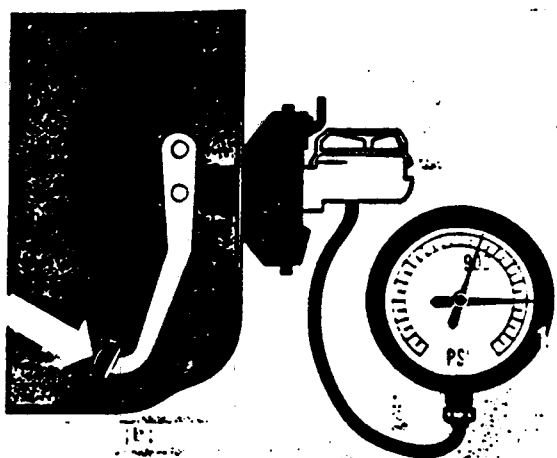


Fig. 4 — Pedal effort is hard after booster runout.

square inch. Beyond this booster runout point, brake pedal operation feels so hard that the driver may think it has bottomed out.

(Note: Booster runout occurs at pressures normally above wheel skid and would only be detected with the car not in motion.)

Actually, the pedal is above the floor. The driver can move the pedal further and produce more hydraulic braking force, but it's all manual action from then on. No more power assist is available after booster runout.

"SPONGY" BRAKES

So far, we've seen how the current pedal linkage system contributes towards a softer pedal feel and why a hard pedal feel is produced by normal booster runout. Now we'll take a look at the causes of a real "spongy" brake condition: air trapped in the hydraulic system and incomplete bedding of brake shoes.

But first, let's find out exactly what we mean by the word, "spongy." Spongy means that the pedal can be depressed for a longer than normal distance with a gradual increase in resistance as the pedal moves downward.

A true spongy pedal feel is different from the feel experienced during an hydraulic leak. If a leak occurs either in the master cylinder (due to brake fluid seeping past a piston seal) or somewhere in the brake lines, the pedal moves closer to the floor as in a spongy brake condi-

tion. With a leak, however, the pedal continues to move without the driver increasing the pedal force. This leak symptom is often called a "fall away" pedal. Some customers may incorrectly refer to a fall-away pedal as a spongy pedal.

TRAPPED AIR

If one of the master cylinder reservoirs is dry due to a leak somewhere in the hydraulic system, you know that air has entered the system.

You can check for trapped air from the driver's seat with the pedal test. But first check the fluid level in both master cylinder reservoirs. The fluid should come to within about $\frac{1}{4}$ inch of the top of the reservoirs. (It's normal for the fluid level in the primary reservoir to be a bit lower due to disc brake pad wear.) Then check out the warning light by turning the ignition key to the

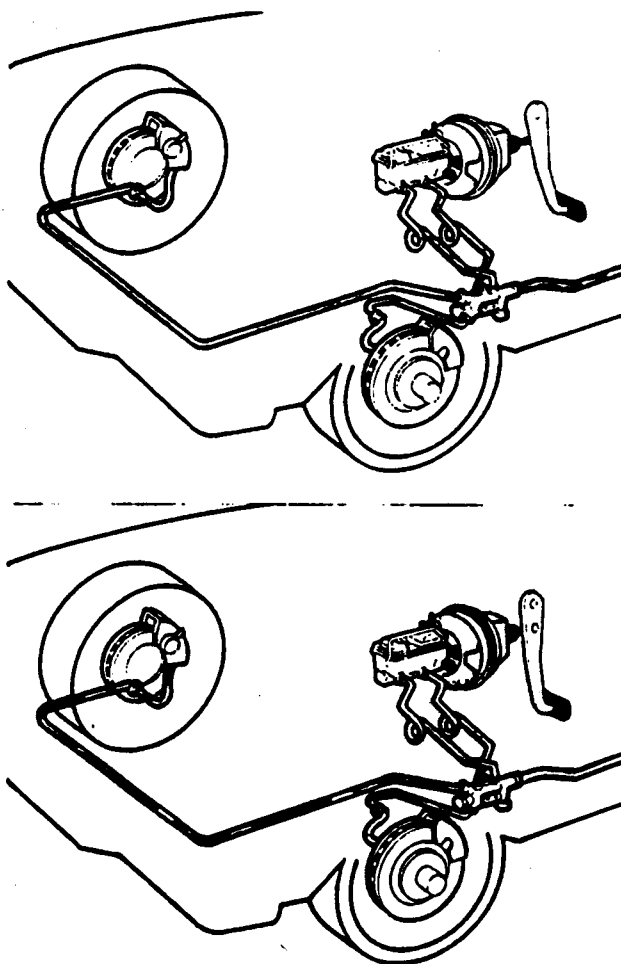


Fig. 5 — Trapped air compression causes spongy pedal feel.

start position. Let the key return to the run position. With the engine running, slowly apply the brakes, gradually increasing the pedal effort to a very high force.

If the brake warning light comes on after you've applied light pedal effort, that's a sure indication there's lots of air in the system. Chances are the pedal will move closer to the floor than normal due to the compression of the air trapped in the system. The air compression creates the spongy feel. On the other hand, if you must exert heavy pressure on the pedal before the warning light comes on or the light does not come on at all, only a small amount of air is trapped in the system.

In a trapped air condition, the brake warning light will go off as soon as the brake pedal is released.

MASTER CYLINDER AT FAULT?

However, if the warning light does not go off even after you release pedal effort, either the master cylinder is bad or the hydraulic system has a serious leak.

It's a good idea to conduct the pedal test at least twice before deciding to replace the master cylinder. Again, follow the same procedure as the test for trapped air.

If there's no sign of leaks, and the brake warning light stays on after you lift your foot off the pedal, the master cylinder is probably bad.

The master cylinder becomes faulty when brake fluid can seep by a worn or cut seal as the piston moves forward during brake application. This fluid seepage around a piston seal prevents the full amount of hydraulic fluid from reaching either the front or rear brakes and creates a pressure imbalance in the system, triggering the warning light. But, unlike trapped air, the pressure imbalance causes the warning light to stay on after the brake pedal is released.

In addition, both a faulty master cylinder or a serious leak may allow the pedal to slowly fall away toward the floor with light pedal force. A system with trapped air will not have pedal fall-away. In a trapped air condition, pedal position is maintained at a constant pedal force.

BLEEDING THE SYSTEM

To remove trapped air, thoroughly bleed the system according to methods given in your service manual.

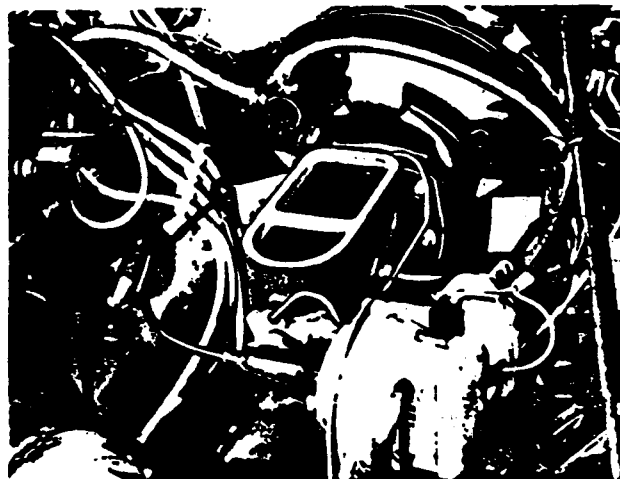


Fig. 6 — Reservoirs should be full before bleeding.

If you find one of the master cylinder reservoirs dry or if you're installing a new or rebuilt master cylinder, begin bleeding at the master cylinder using Bleeder Tubes C-4029. Otherwise, begin bleeding at the right rear wheel.

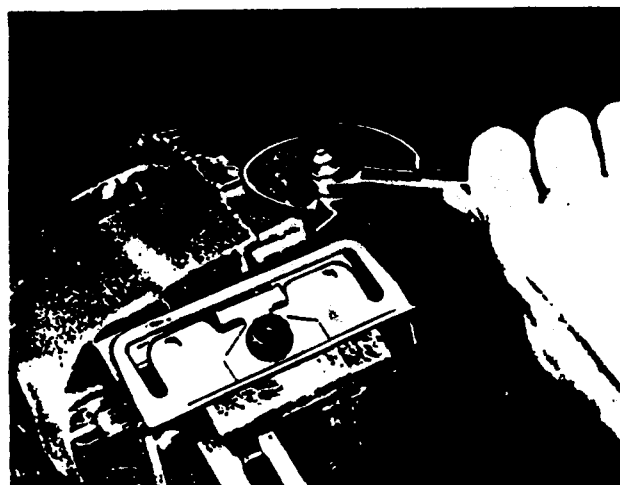


Fig. 7 — Open bleeder screw at least one full turn.

Also, if you pressure-bleed the system (using Pressure Bleeder C-3496B), first install clip C-4121 on the stem of the hold-off valve. The clip keeps the hold-off valve open during bleeding operations, allowing fluid to reach the front brakes. Don't forget to remove the clip when you're through bleeding the brakes.



Fig. 8 — Remove clip after pressure bleeding.

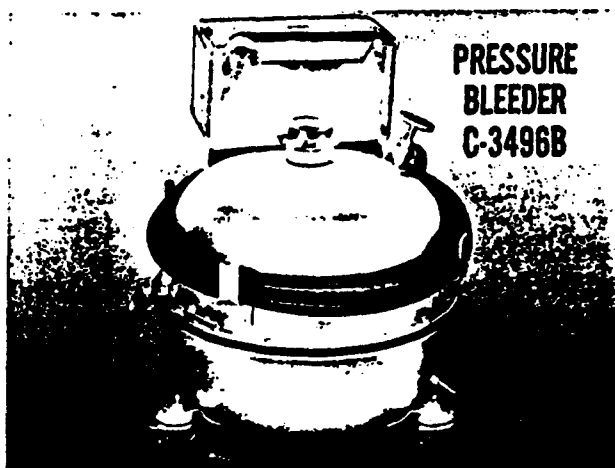


Fig. 9 — Good bleeding equipment is important.

INCOMPLETE BEDDING

In some instances, the incomplete bedding of

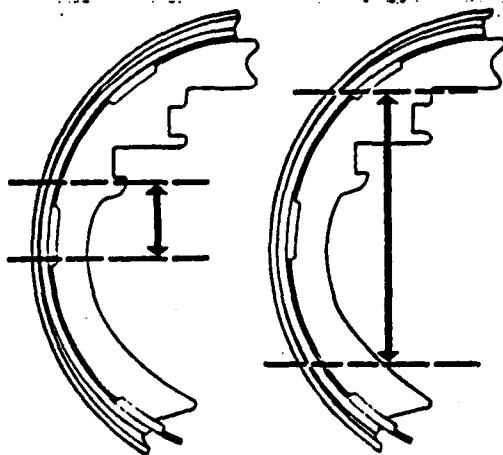


Fig. 10 — Bedded area enlarges as mileage increases

rear brake shoes on low-mileage cars can also produce a spongy pedal feel. The cure for this condition is for the customer to keep driving his car. Usually, the shoes are completely bedded after 1,500 to 2,000 miles, depending how often the brakes are used.

We might as well mention here that incomplete shoe-to-drum contact can also be caused by the automatic adjuster on the rear brakes not being allowed to work properly. This lack of adjustment, which may lead to a spongy pedal feel, occurs when drivers back up and consistently shift from reverse to drive without firmly stepping on the brake pedal.

It's easy to remedy this problem. Find a lightly traveled stretch of road and drive the car in reverse, firmly applying the service brake while still in motion. Do this six to eight times to eliminate the low pedal condition.

OTHER PEDAL PROBLEMS

Besides an overly soft or spongy pedal, we'll cover some other pedal-related problems you may run into: varying pedal travel, incomplete pedal return, and a loose, pulsating or overly-hard pedal.

VARYING PEDAL TRAVEL

Loose front wheel bearings can cause the pedal travel to vary in length each time the driver applies the brakes. (This condition does not block the pedal from completely returning to the release position.) To eliminate this condition, adjust the front wheel bearings according to the method given in your service manual.

INCOMPLETE PEDAL RETURN

A missing spacer in the brake booster linkage or a misadjusted stop light switch may prevent the pedal from fully returning to the release position after brake applications.

(Note: Full-size passenger cars, Chrysler, Gran Fury and Royal Monaco models, do not have a separate booster linkage.)

The incompletely returned pedal may cause a brake drag condition by keeping the master cylinder pistons from retracting all the way, trapping hydraulic pressure in all four wheel cylinders. Check the Brake Drag section in this Reference Book for further details.

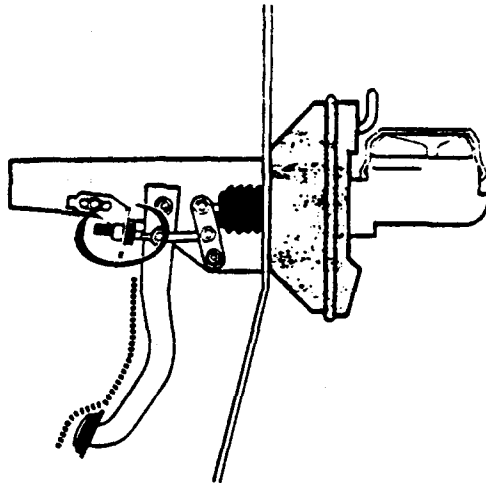


Fig. 11 — Misadjusted stop light switch may prevent pedal return.

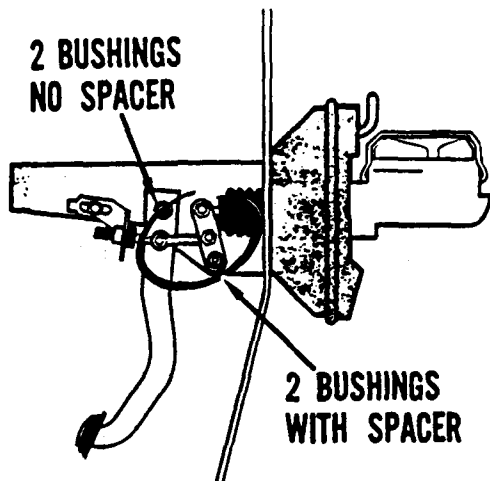


Fig. 12 — Pedals on most cars have bushings and a spacer.

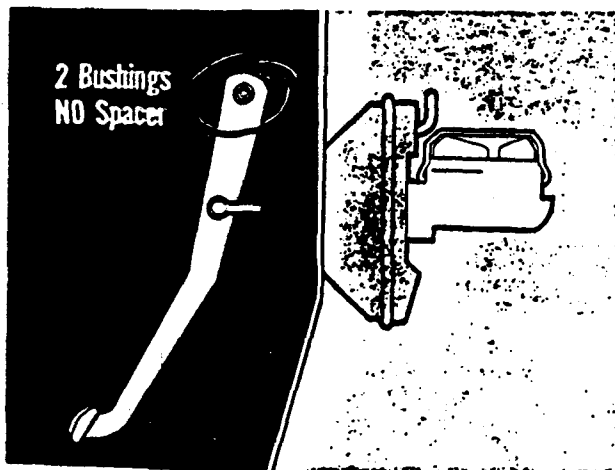


Fig. 13 — Full-size car pedals do not have a spacer.

LOOSE OR SLOPPY PEDAL

Missing plastic bushings in the upper pivot of the pedal may result in a loose pedal. The absence of one or both bushings may allow the pedal to rattle around from side-to-side in the support bracket.

Missing bushings in the pedal linkage may cause a sloppy pedal. Sloppiness shows up as a free up-and-down movement of the pedal.

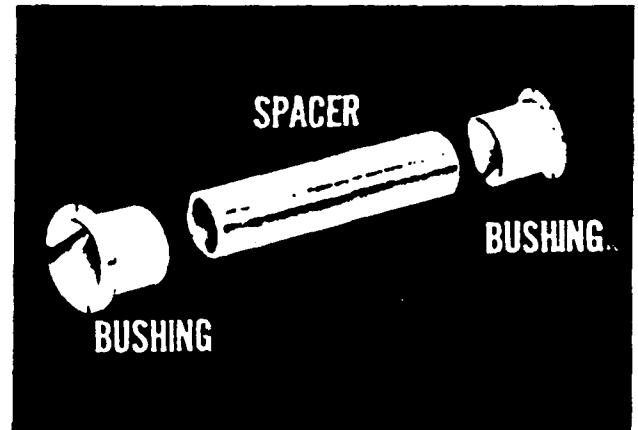


Fig. 14 — Missing spacer or bushings cause pedal problems.

PULSATING PEDAL

If the brake pedal pulsates or has rapid up-and-down movements during light brake applications, one or both of the rear drums may be out-of-round. In this condition, the pulsation varies with the vehicle speed. Surging may be present during braking.

Usually the pulsation does not show up during hard braking due to heavy pressure from the brake shoes which temporarily rounds out the drum or drums.

The remedy for this form of brake roughness is given in the section on Brake Roughness. Rear Brakes, later on in this Reference Book.

OVERLY-HARD PEDAL

If the driver must exert a much higher than normal effort on the brake pedal to stop or slow the vehicle, the linings may be contaminated or a piston may have seized in one or both of the front calipers.

Gross lining contamination from leaking brake fluid or lubricant may cause a lack of friction

between the brake lining and rotor or drum, allowing the brakes to slip. (Note: A lesser degree of contamination may be responsible for a brake "grab" condition.)

The need for heavy pedal effort may also result from a seized piston in one or both of the front disc brake calipers. In this instance, corrosion in the caliper cylinder bore either prevents the piston from moving outward or else locks the piston in the outward position.

In the case where a piston is locked in the inward position, the other wheel brakes take on more of the stopping load, forcing the driver to exert more than the usual pedal pressure. If one piston is seized, a brake pull condition may also exist. If both are seized, premature rear brake lockup could result.

If a piston is seized in the outward position, the result may be premature lining wear and a heat-spotted rotor.

2 ROUGHNESS AND VIBRATION

BRAKES NOT APPLIED

If there's roughness or vibration when the brakes are not applied, first inspect front suspension alignment and tire balance. Should these check out okay, inspect front and rear tires and wheels for both excess radial and lateral runout using Wheel and Tire Runout Gauge C-3339.

Start out by measuring radial runout since radial rather than lateral runout is more likely to cause a roughness or shake problem. Radial runout of more than .100 inch almost certainly will produce roughness. Radial runout in ex-

cess of .060 inch may sometimes result in unwanted vibration.

Lateral runout of more than .080 inch could cause some roughness.

BRAKES APPLIED

If the roughness or vibration shows up only when the brakes are applied, you can conduct the parking brake test or the service brake test to determine whether the roughness is caused by the front or rear brakes.

PARKING BRAKE TEST

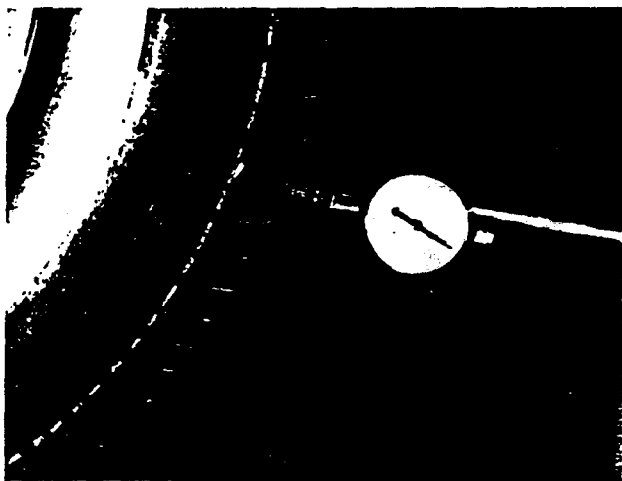


Fig. 15 — Measure runout with dial indicator C-3339.



Fig. 16 — Go easy on pedal during parking brake test.

At low speed, hold out the parking brake release and gently apply the parking brake. Be careful not to apply too much pressure on the pedal. As the car slows, you might feel a slight surging motion. This surging feel is normal and should not be mistaken for brake roughness.

If there's no sign of abnormal roughness when you apply the parking brake, you know the problem is in the front brakes. However, if you do feel excessive roughness or vibration when you apply the parking brake, the rear brakes are the source of the trouble.

SERVICE BRAKE TEST

While driving at slow speed, apply the service brake pedal. If the steering wheel oscillates, the roughness is in the front brakes. If the steering wheel does not oscillate, the roughness is in the rear brakes.

FRONT BRAKES AT FAULT

Front brake roughness may be caused by seized

caliper pistons, varying rotor thickness or excess lateral runout.

SEIZED PISTONS

Check for seized pistons in both front calipers. Pistons seized in the out position can produce hard spots on the rotor which may show up as discolorations. These hard spots, due to overheating, can cause irregular friction between the rotor and brake linings. This irregular friction produces brake roughness. Seized pistons may also produce premature lining wear and brake dragging.

(Note: Even though seized pistons may cause rotor scoring, this condition alone cannot produce brake roughness.)

A seized piston may also cause front brake pull which is explained in another section of this Reference Book.

SEIZED PISTON CHECK

To properly check for a seized piston, first remove the master cylinder cover to reduce fluid

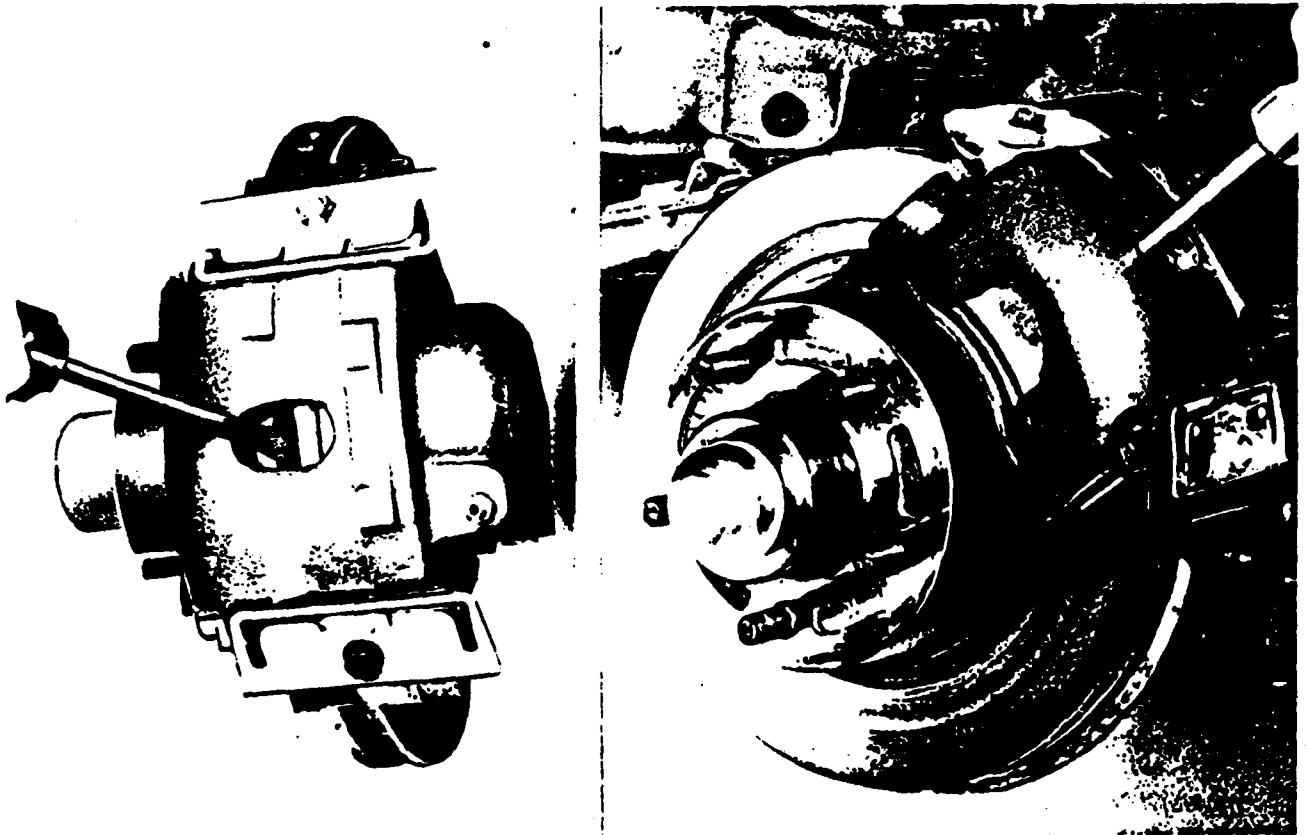


Fig. 17 — Here's the proper way to check for seized piston.

pressure during the test. With the wheel off, insert a heavy screwdriver through the slot in the top of the caliper and into the space between two cooling vanes. Then push the screwdriver handle toward the outboard side of the caliper, forcing the rotor and inboard pad against the caliper piston.

A seized piston will prevent any movement of the screwdriver.

(Note: Do not check for a seized piston by applying the screwdriver directly on the caliper piston. Direct contact with a screwdriver could damage the plastic pistons now used in many Chrysler Corporation passenger cars.)

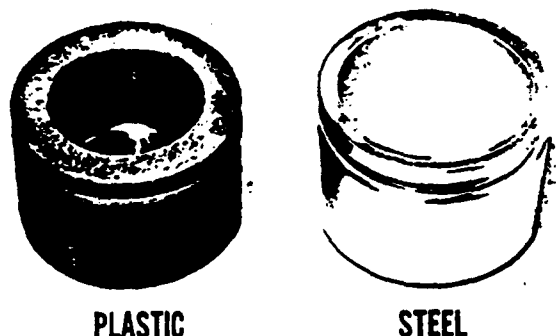


Fig. 18 — Calipers use both plastic and steel pistons.

ROTOR RUNOUT AND THICKNESS VARIATIONS

Before measuring rotor runout with dial indicator C-3339, first temporarily adjust the wheel bearings to zero end play. When mounting the dial indicator on the steering arm, make sure the indicator plunger contacts the rotor face one inch from the edge.

Runout should not exceed .004 inch. If runout does exceed this amount, recondition the rotor, being careful to remove as little of the rotor surface as possible from both sides of the disc. Minimum rotor thickness must not be less than .94 inch. Replace the rotor if necessary.

To measure the thickness variation, use a micrometer, placing it at 12 equally distant spots

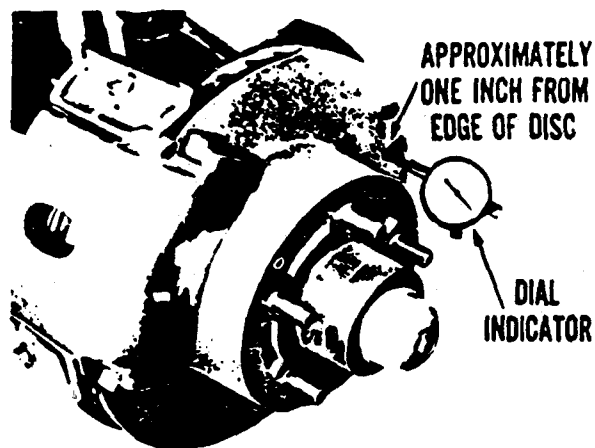


Fig. 19 — Measure rotor runout with dial indicator C-3339.

along the rotor one inch from the edge of the disc. If the thickness varies by more than .0005 inch, the rotor should be reconditioned or replaced.

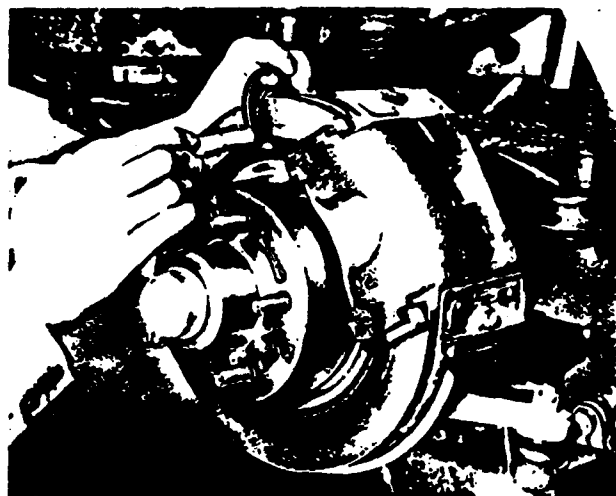


Fig. 20 — Measure thickness at 12 equally distant points.

REAR BRAKES AT FAULT

If the parking brake test or the service brake test shows that the rear brakes are the source of roughness, check the rear brake drums for hard spot irregularities or excessive runout or out-of-roundness.

HARD SPOTS

Besides brake roughness, hard spots may also

cause a rear brake chattering noise due to irregular friction.

Since hard spots are produced by a continual overheating of the drum, the cause is usually a rear brake drag condition. This drag condition forces the shoes to be in constant tight contact with the drum.

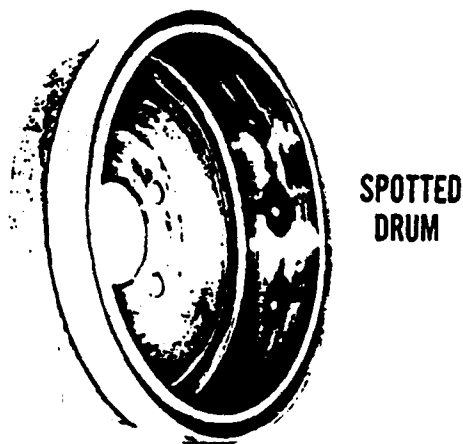


Fig. 21 — Excess heat produces hard spots.

If one or both drums are spotted, inspect the brake linings for premature wear. Premature lining wear nearly always indicates an overly tight parking brake cable due to either a misadjusted parking brake or a cable seized by corrosion.

However, if the parking brake adjustment and cable check out okay, the driver may be continually riding the service brake with his foot.

The drum or drums with hard spots must be replaced. Hard spots cannot be effectively turned out. In addition, replace the brake linings from the affected drum or drums. Linings which have caused hard spots on an original

drum will cause hard spots on a new drum.

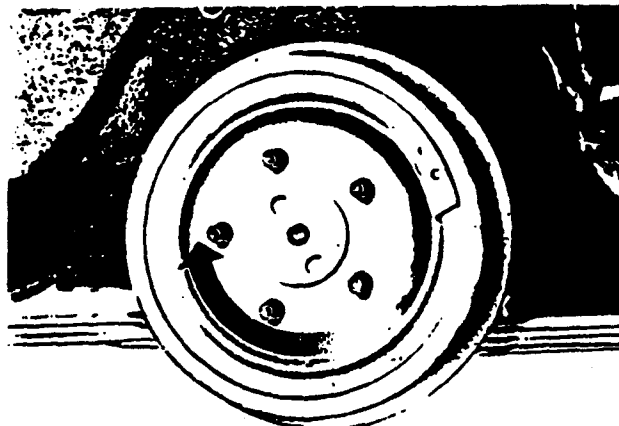
EXCESS RUNOUT

Excess runout or out-of-roundness usually produces a form of brake roughness including pedal pulsation and surging during light brake applications.

Measure drum runout on a brake drum lathe. Runout should not exceed .006 inch out-of-round; also there should not be a variation in drum diameter of more than .002 inch.

If the drum exceeds either of these dimensions, carefully recondition it. Never remove more than .005 inch of drum surface at any one time.

You might find that drum runout does not exceed specifications. In this case, rotate the drum a distance of two axle flange studs away from the original position before reinstalling it to reduce the pulsation and surging.



ROTATE BY TWO STUDS

Fig. 22 — Drum rotation reduces effects of out-of-roundness.

3

BRAKE DRAG

Although rear brake drag is usually caused by an overly tight parking brake cable, a brake

drag in all four wheels is the result of trapped hydraulic pressure. This condition may be

caused by incomplete return of the service brake pedal or contaminated brake fluid.

INCOMPLETE PEDAL RETURN

As we mentioned earlier in this Reference Book, an incompletely returned pedal may prevent the master cylinder pistons from completely retracting and thereby may trap hydraulic pressure in all four wheel cylinders. The causes of incomplete pedal return are a misadjusted stop light switch or a misassembled pedal linkage.

A stop light switch and bracket assembly which is adjusted too close to the pedal linkage or brake push rod prevents full pedal return. Loosen the switch and bracket assembly in the pedal support bracket. Push the brake pedal down and allow it to freely return to the position. After placing the proper spacer on the linkage or push rod, push the switch and bracket assembly toward the linkage or rod until the plunger is depressed. Then tighten the switch bracket screw to 75 inch-pounds torque.

A missing spacer in the pedal booster linkage will create friction between the linkage and the pedal support bracket. This friction may prevent the pedal from completely returning to the release position after brake application and can cause brake drag.

CONTAMINATED BRAKE FLUID

Brake fluid which is contaminated by oil or any other petroleum product causes rubber parts, such as seals, in the hydraulic system to swell, trapping hydraulic pressure.

You can easily check for fluid contamination by inspecting the master cylinder cover gasket. If the gasket is swollen or grossly out of shape, the brake fluid is contaminated.

Since fluid contamination can affect all the rubber parts in the brake system, all components of the brake system should be replaced or rebuilt. These components include the master cylinder, calipers, wheel cylinders, hoses and valves.

4 FRONT BRAKE PULL

BRAKES NOT APPLIED

If the car pulls or drifts to either side when the brakes are not applied, chances are the cause is poor suspension alignment, steering linkage problems or radial tire pull.

BRAKES APPLIED

Should the car pull to either side as you apply the brakes, the cause may be a seized piston or contaminated brake linings. As previously mentioned, these two conditions may also cause an overly hard brake pedal.

DRIFT AND PULL

A seized piston in one of the calipers may result in a drift toward the side of the affected wheel brake when the brakes are not applied.

But when the driver applies the brakes, the car most likely will pull toward the side opposite the caliper with the seized piston.

In the case of a seized piston, the caliper must be reconditioned or replaced if necessary.

"GRAB" AND "SLIP"

Lining contamination by either brake fluid or lubricant may cause the linings to develop too high a friction point with the rotor and produce a brake "grab" condition during moderate pedal applications. However, if the linings soak up a sufficient amount of the contaminant, the linings will "slip" or lose friction with the rotor surface.

In addition, contamination of the rear linings may also cause a premature rear brake lockup condition in very light braking situations.

5 REAR BRAKE LOCKUP

Besides being caused by contamination of the rear brake linings, rear brake lockup during low deceleration stops may also be the result of:

- an overly-tight parking brake adjustment,
- out-of-round or heat-spotted drums,
- front brake malfunction, or
- a faulty proportioning valve.

A parking brake adjusted too tight produces excess friction between the linings and drums.

If a drum is seriously out-of-round, the area of the drum with the smallest diameter will grab the linings as the drum rotates during brake application. A front brake malfunction, as we mentioned before, forces the rear brakes to take on most or all of the stopping load, something they are not designed to handle.

If both rear wheels lock under moderately hard braking, the proportioning valve may be faulty. Your service manual gives the proper test procedures. Replace the unit if necessary.

6 NOISES

Individual brake noises are usually characteristic to either the front or rear brakes.

FRONT BRAKE NOISES

By far the most common front brake noise complaint is a high-pitched squeal heard during light pedal applications. This squeal is caused by the vibration of brake shoes. Although the squeal does not affect brake performance, installing shoes with riveted linings will solve the problem in most cases. Front brake squeal rarely occurs in full-size Chrysler Corporation passenger car models.

If you hear a scraping sound originating from the front brakes, a bent splash shield may be contacting a rotor, or else a small stone or other foreign object could be lodged between the shield and rotor. Also, in high-mileage vehicles, very worn-out brake shoes may be scraping against the rotor.

For disc brakes with slider-type calipers, a rattle may be produced by a loose outboard brake shoe, a missing anti-rattle spring or a missing "O" ring at one or both of the sliders.

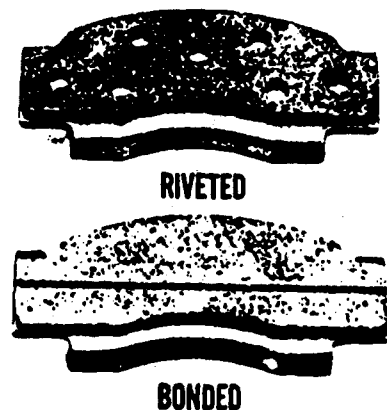


Fig. 23 — Riveted linings reduce brake squeal.

NO CLEARANCE



Fig. 24 — There should be no clearance between flange and ledge.

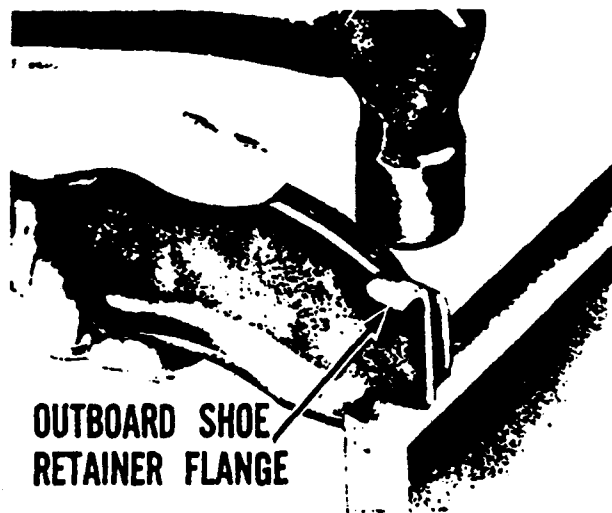


Fig. 25 — Bend flange to eliminate clearance and rattle.

REAR BRAKE NOISES

A chirp which varies according to car speed indicates a lack of lubricant on the brake platform plate shoe tab contact areas. The rapid movement of metal on metal produces the chirp. The lack of lubricant is usually caused by excess brake shoe movement due to a slightly out-of-round drum.

To remedy this condition, first loosen the brake shoes by removing the retainer and retainer spring from each shoe with Tool C-4070. Then rub a light film of Mopar Multi-Purpose Lubricant #2932524 on each shoe tab contact area. After shoe retainers and springs are reinstalled, rotate the drum a distance of two axle flange studs from its original position before placing it back on the axle flange.

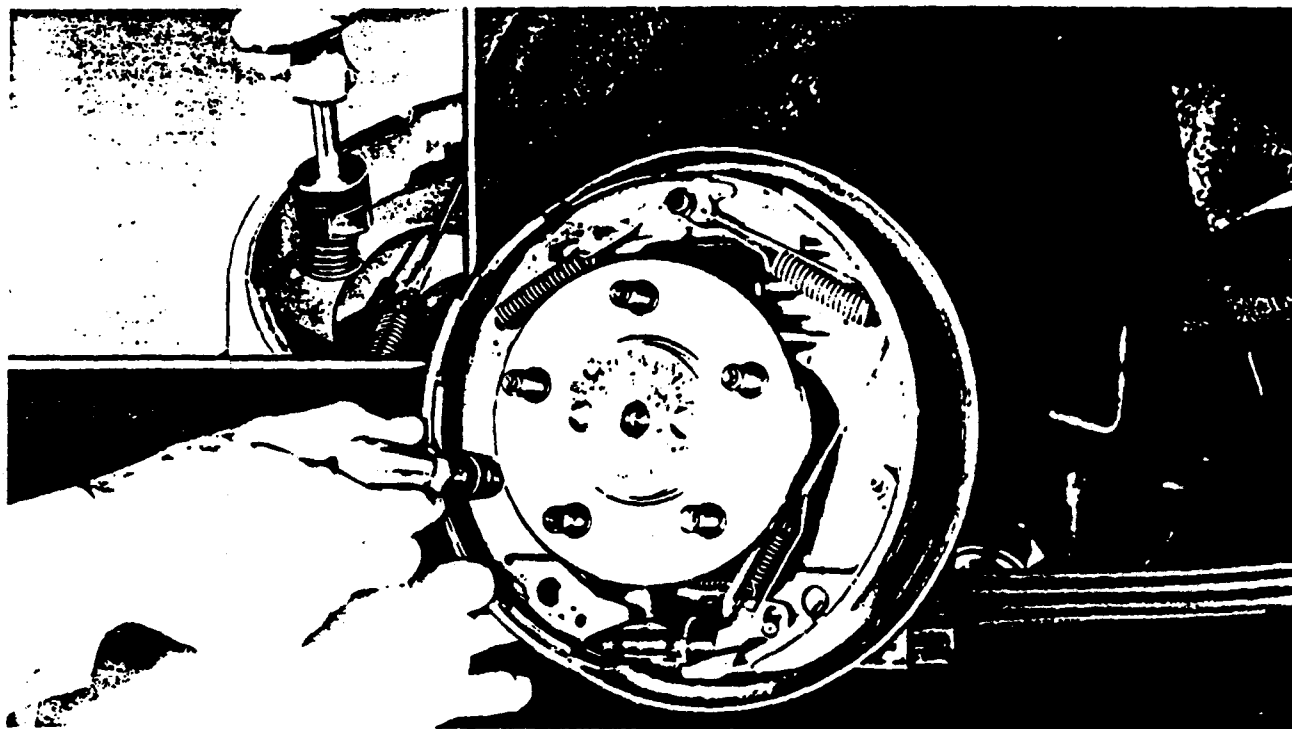


Fig. 26 — Loosen brake shoes with tool C-4070.



Fig. 27 — Lubrication helps to eliminate chirp.

Rear brake chattering noise during high-speed stops is likely to be the result of one or both drums having hard spot irregularities due to overheating. As we've said before, brakes may reach excess temperatures due to a brake drag condition caused by either a mechanical difficulty, such as a misadjusted parking brake, or the driver riding the service brake pedal.

A thunking sound from a rear brake may indicate a threaded or grooved drum. During brake

applications, the grooves temporarily force the shoes away from the platform plate. When the tension of the shoe retainer springs reach a certain point, the shoes snap back and hit the platform plate. In many cases, only a light sanding of the drum is required to remove the threads produced by improper machining of the drum.

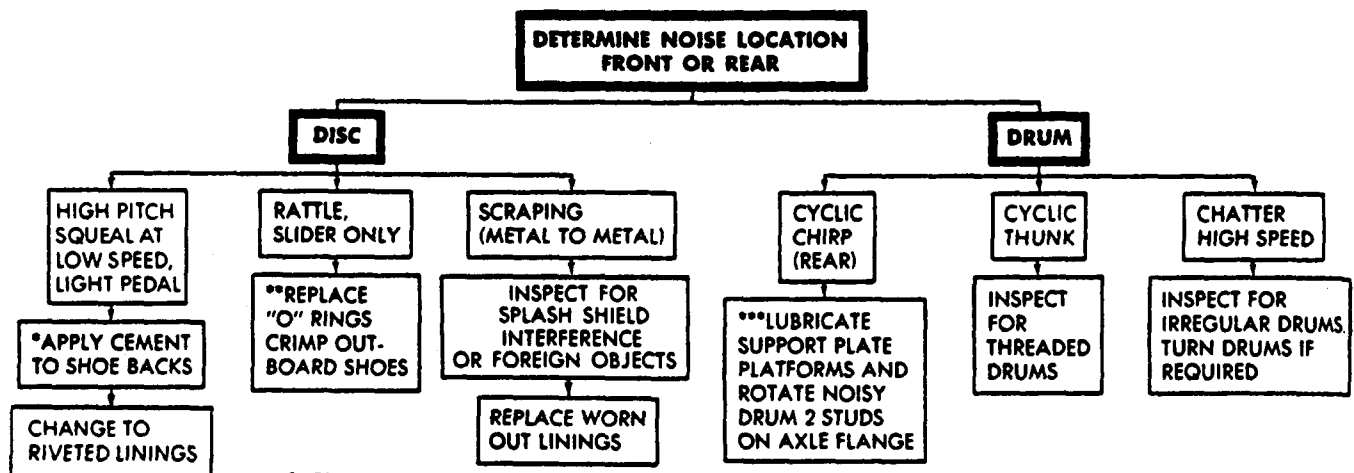
Lastly, a rear brake scraping noise which only occurs during sharp cornering and varies with vehicle speed may be the result of intermittent contact of the brake drum with the brake platform plate.

Check the brake support lip for high points. File or grind the support plate if necessary, taking off from .030 to .040 inch of material. Make sure the shavings are removed before reinstalling the drum.

If the scraping noise cannot be eliminated by filing or grinding the platform plate, you'll have to replace the axle shaft.

A rear brake scraping noise which shows up only during brake application usually indicates very worn shoes in one or both rear brakes.

BRAKE NOISE DIAGNOSIS



*APPLY MOPAR CEMENT PART NUMBER 3683897, OR EQUIVALENT, TO SHOE BACKS AND TO PISTON AND CALIPER FINGER CONTACT AREAS. REMOVE ALUMINUM GASKET IF SHOE IS SO EQUIPPED.

**INSTALL "O" RINGS (AROUND ADAPTER) BETWEEN MACHINED "WAYS" OF CALIPER AND ADAPTER.

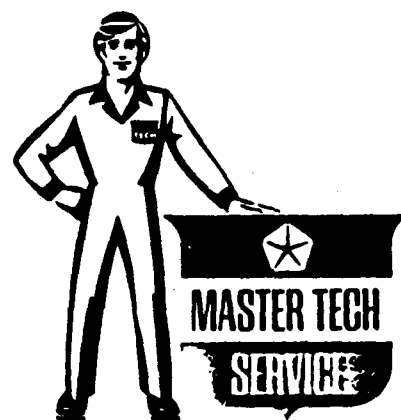
***MOPAR MULTIPURPOSE LUBRICANT, PART NUMBER 2932524, OR EQUIVALENT.

SEPTEMBER

MASTER TECH

81

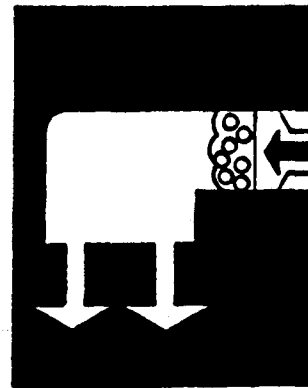
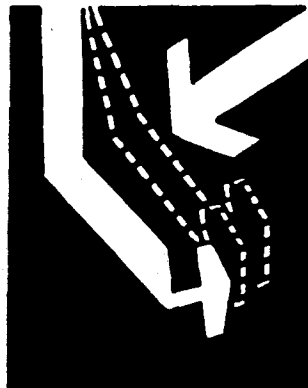
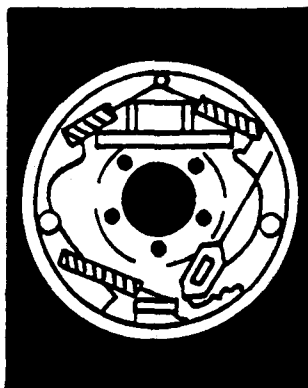
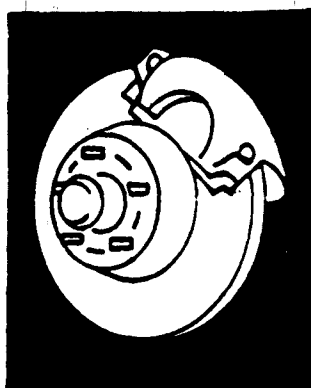
DIAGNOSING FRONT-WHEEL-DRIVE BRAKE SYSTEMS



SERVICE AND PARTS OPERATIONS



**CHRYSLER
CORPORATION**



Chrysler Corporation's front-wheel-drive brake systems are safe, responsive, durable, and easy to service. Many of the components such as the Chrysler-designed tandem-aluminum master cylinder, pin-type sliding caliper, phenolic pistons, and damped iron rotors were designed for weight reduction, reliability, and performance.

Since the introduction of the Omni and Horizon models in 1978, several design, component, and service changes have been made to improve the overall front-wheel-drive brake system performance. In this session, we will explain those changes and review the service procedures you'll need to know to keep your customers' brakes performing properly.



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FWD Brake System Update

Front-wheel-drive vehicles are unique in many ways. Because of their drive train and weight-saving characteristics, almost every system on the car had to be redesigned. The brake system was no exception. Your familiarity with rear-wheel-drive brake systems will be helpful, but there are some important differences with the front-wheel-drive system you should know.

BRAKE OUTPUT AND CRISSCROSS PATTERN

Differences in weight distribution between front- and rear-wheel-drive cars played a big part in the design of the overall front-wheel-drive brake system. Because front-wheel-drive cars have proportionally more weight in the front end, the front brake output was increased to 85 percent (Fig. 1). Likewise, the rear brake output was lowered to 15 percent to limit lockup.

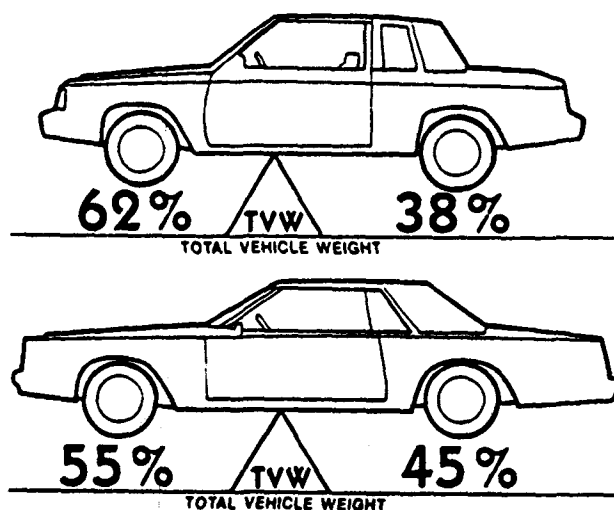


Fig. 1 — Front-wheel-drive cars have more weight in the front end so front brake output was increased to 85 percent.

All of Chrysler's front-wheel-drive brake systems have excellent stopping capability before or even during lockup. Even so, remember, skidding is *not* optimum

braking. When brakes do lockup, loss of directional stability may occur.

The design of the suspension geometry of Chrysler's front-wheel-drive cars allows the use of a crisscross brake system. The right front and left rear and the left front and right rear brakes are two separate hydraulic systems (Fig. 2).

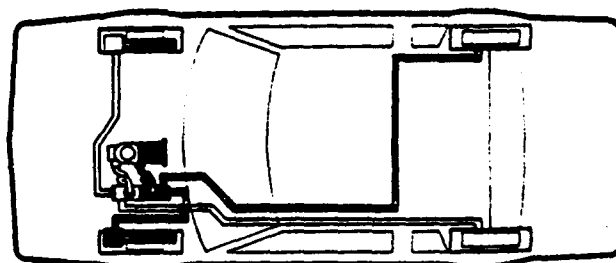


Fig. 2 — The crisscross hydraulic brake systems work independently for greater safety.

This kind of configuration is an excellent safety feature. Because if a failure occurs in any part of one of the hydraulic systems, the other system is not affected. Therefore, little or no loss of directional stability will occur when the brakes are applied.

FRONT-WHEEL-DRIVE BRAKE COMPONENTS

With the introduction of Chrysler's front-wheel-drive cars, many of the brake components have been redesigned for better durability and performance (Fig. 3).

For example, the tandem-aluminum master cylinder is lighter, yet it has durability characteristics that exceed the cast iron master cylinder it replaces. The lightweight nylon reservoir has excellent durability and improved serviceability (Fig. 3).

New thermoplastic brake tube clips (on K Car only) are corrosion resistant and lightweight. (Fig. 3).

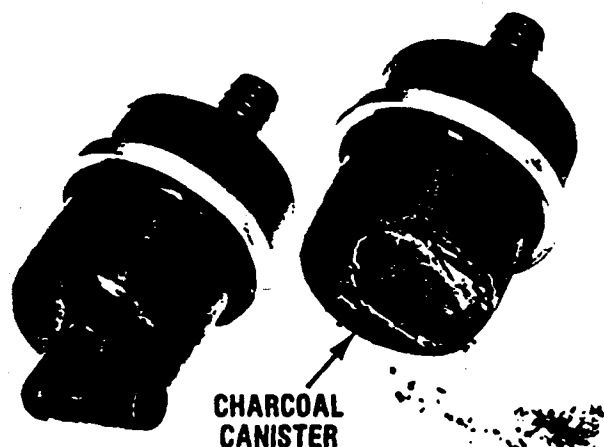
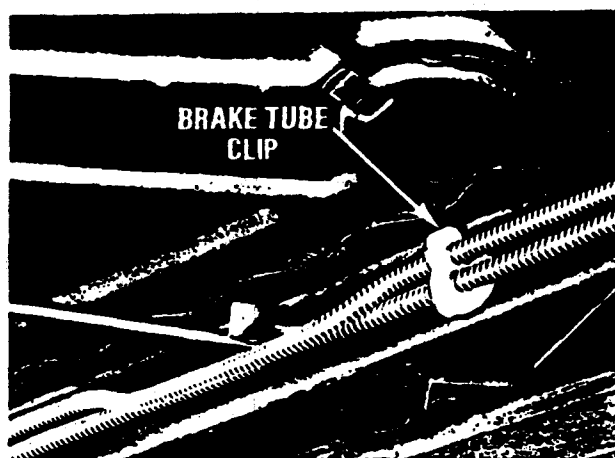
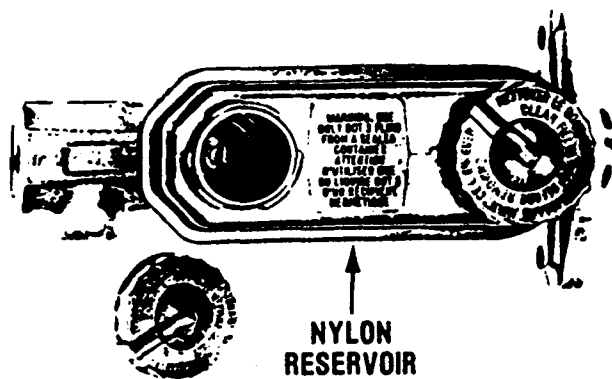


Fig. 3 — The lightweight, tandem-aluminum master cylinder, the nylon reservoir, the thermoplastic brake tube clips, and the charcoal canister are some of the new brake system components.

BOOSTER VACUUM SOURCES

On 1.7- and 2.2-liter engines, vacuum for the booster on power brake systems is sourced at the carburetor

base. On 2.6-liter engines, booster vacuum is derived from the intake manifold (Fig. 4). The reason for this

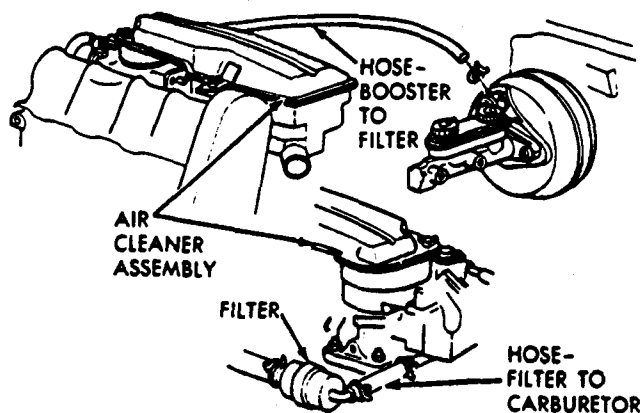
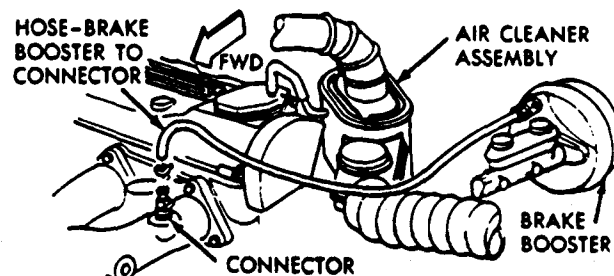


Fig. 4 — The 2.2-liter engine brake booster obtains vacuum from the carburetor base.



The 2.6-liter engine brake booster derives vacuum from the intake manifold.

difference is related to the oxygen feedback systems on the 1.7- and 2.2-liter engines. If the booster vacuum was derived from the intake manifold on these engines, each brake application would inject a slug of air that would give the oxygen sensor a false reading — resulting in poor driveability. To eliminate this driveability

problem, the vacuum source was changed to the carburetor base. But by sourcing vacuum at the carburetor base, there is an increased likelihood of fuel vapor collecting in the booster; therefore, to trap these vapors, a charcoal canister has been added to the vacuum circuit (Fig. 3).

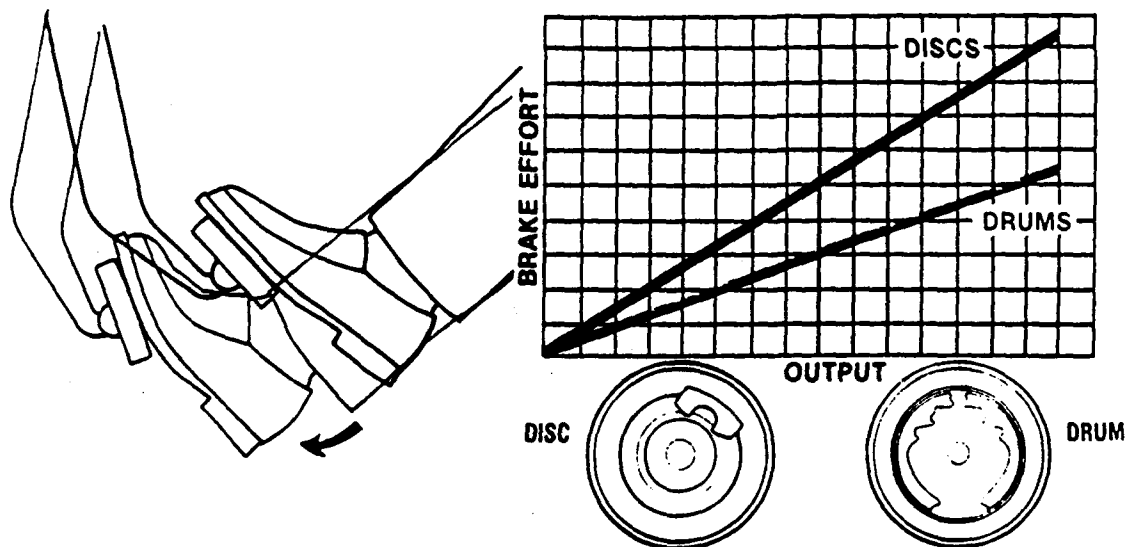


Fig. 5 — The K Car front discs and rear drums have similar output.

REAR DRUM BRAKES

The rear drum brakes are an internal expanding type of leading-trailing design. This particular design was selected because it provides a more stable balance between the discs and the drums. As the straight lines on the graph indicate (Fig. 5), given the same brake pedal

effort, both the front discs and the rear drums have proportionally similar output.

In addition, the rear brakes and drums are spindle-mounted. That means concentricity is excellent, which results in less tendency for runout or brake surge (Fig. 6).

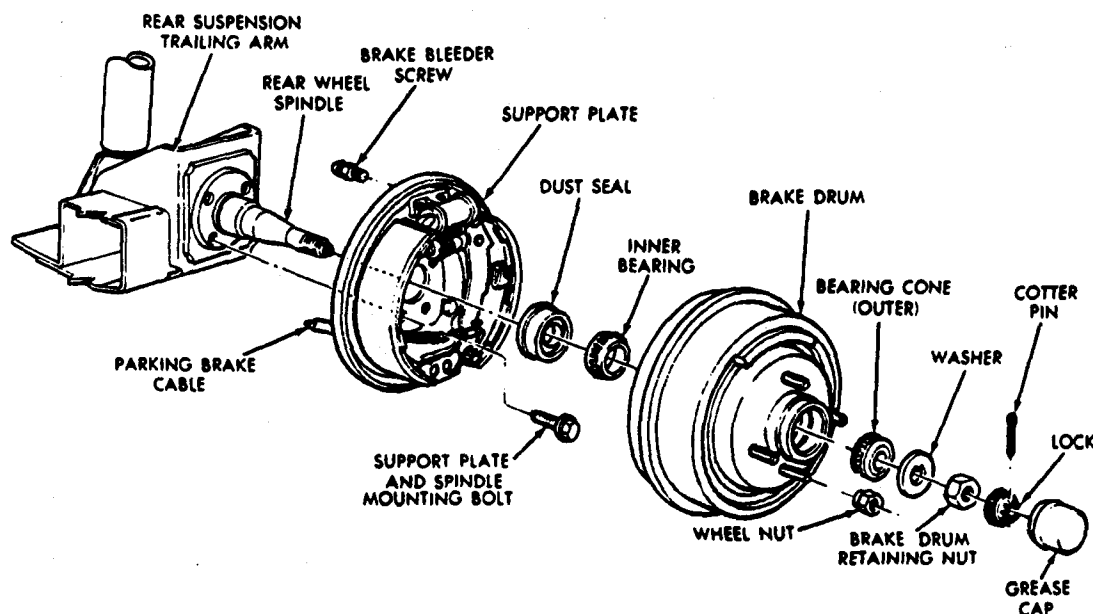


Fig. 6 — Concentricity of the spindle-mounted rear brake helps reduce runout and/or brake surge.

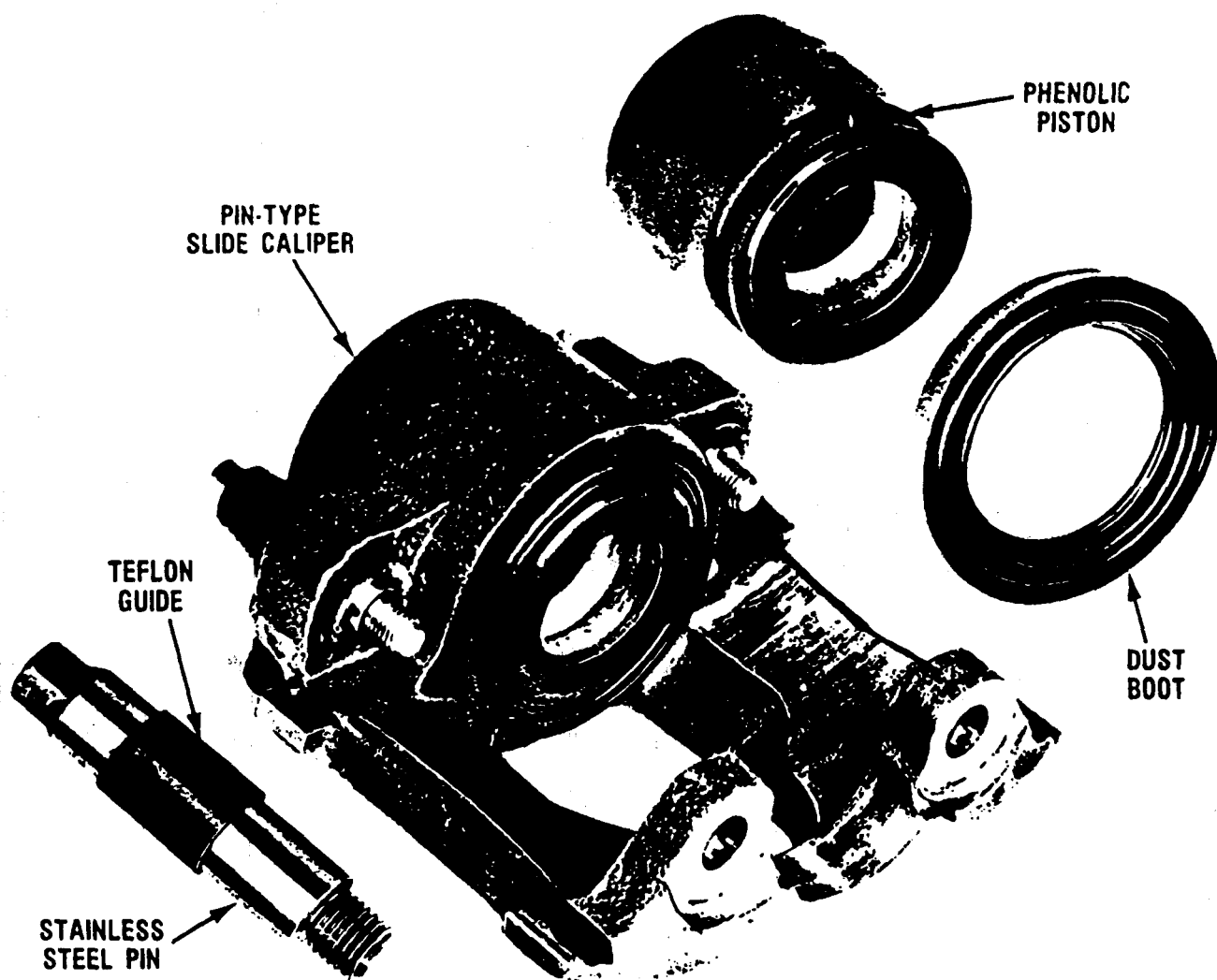


Fig. 7 — The front disc brake components include, a pin-type sliding caliper, Teflon liners on stainless steel pins, press-in dust boots, phenolic pistons, and metallic linings.

FRONT DISC BRAKES

The front brakes are a pin-slider disc type (K Car only). The pin-type sliding caliper is a proven design that has excellent heat transfer characteristics. And because smooth Teflon liners are used on stainless steel pins, drag is very low. You'll also find dust boots, which press into the caliper, are used for positive sealing, and phenolic pistons combine the characteristics of low weight and reduced heat transfer (Fig. 7).

The brake linings are a metallic instead of an organic compound, which has proven to have longer life and better performance (Fig. 8).

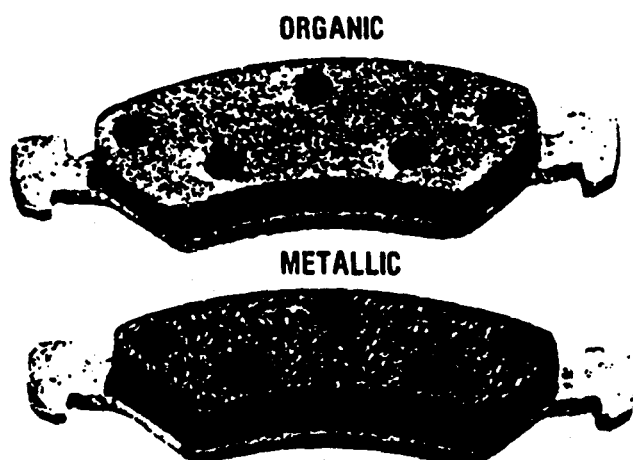


Fig. 8 — Metallic linings replace the organic type used previously.

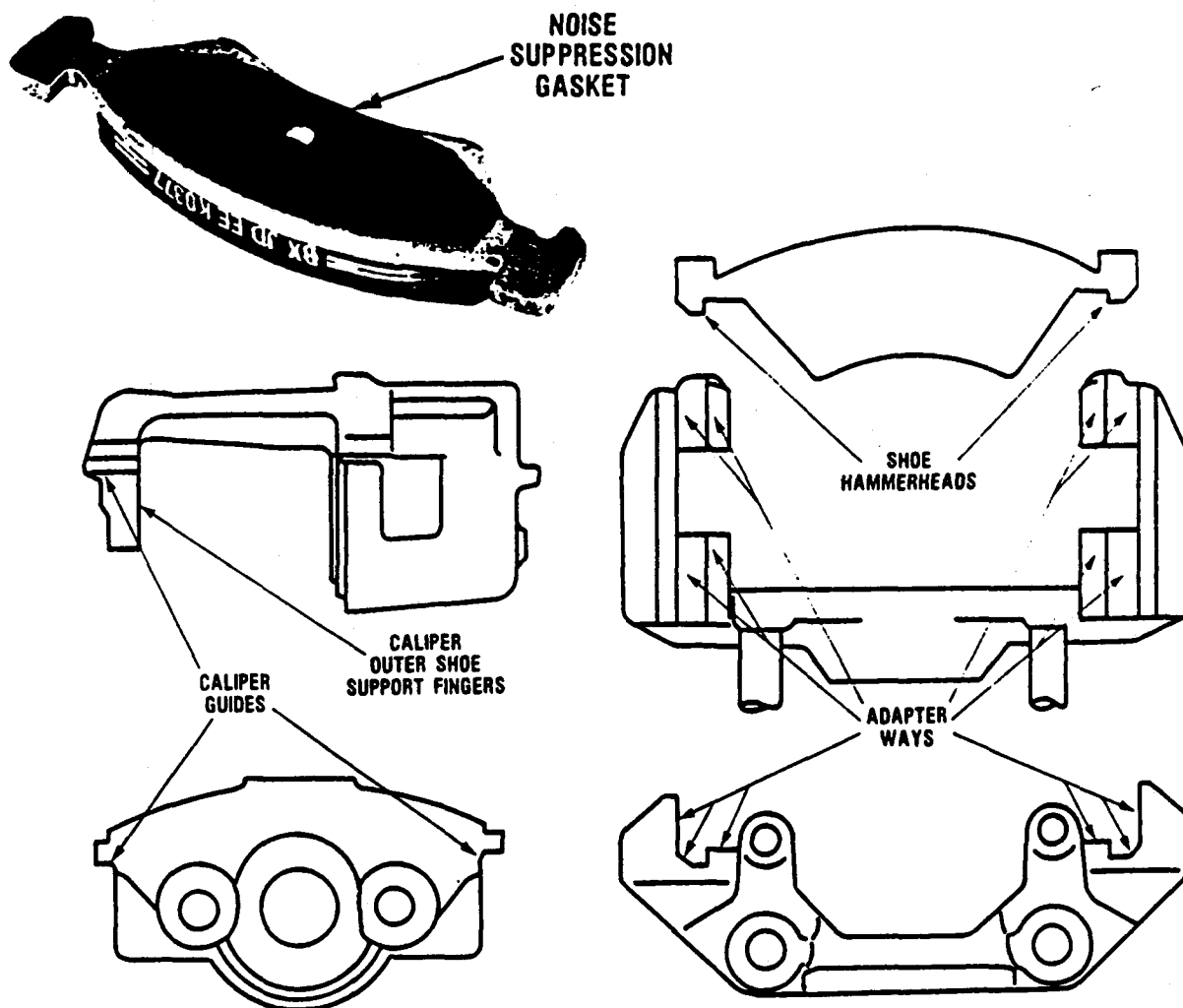


Fig. 9 — A noise suppression gasket bonded to the inboard shoe and grease added to the caliper components, combine to help limit braking noise.

QUIETER BRAKES

To help make braking quieter, three major steps have been taken. First, a noise suppression gasket has been bonded to the back of the shoe (Fig. 9). Second, grease has been applied to the hammerheads of both shoes, the adapter ways, the caliper guides, and the outboard caliper fingers (Fig. 9). And third, a new damped iron rotor replaces the conventional cast iron type. Damped rotors are cast with a higher concentration of carbon and silicone molecules. This composition results in a significant reduction of the "ringing" characteristic often associated with cast iron rotors.

Finally, the large front disc splash shield has been replaced with a smaller design component that functions solely as a bearing retainer (Fig. 10).

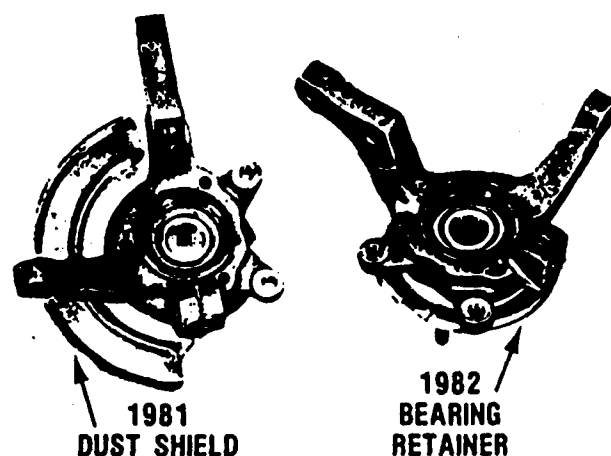
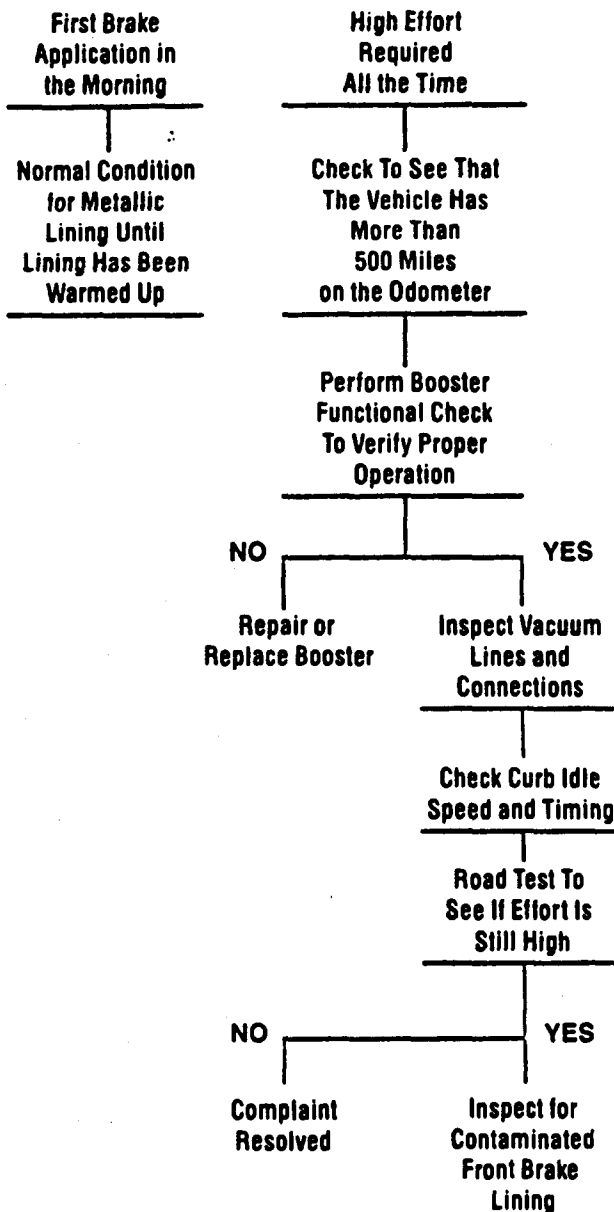


Fig. 10 — The large front disc splash shield has been redesigned for 1982.

2

Diagnosing High Brake Effort

HIGH BRAKE PEDAL EFFORT REQUIRED



When you receive a complaint about high brake effort, it's important to make sure the customer can differentiate between high effort and excessive pedal travel. If possible, road test the car with the customer and observe the condition. If you determine that the complaint is high brake effort, ask the customer if it is most noticeable during the first brake application in the morning.

COLD FRICTION CHARACTERISTIC

The metallic linings used in the front discs have a "cold friction" characteristic that may require slightly higher brake effort during the first few applications. When the linings warm, brake effort lessens.

If high brake effort is required all the time, begin your diagnosis by checking the vehicle mileage. Front-wheel-drive brake linings should not be serviced until the vehicle has been driven at least 500 miles.

Next, if the car has power brakes, check the booster operation. With the engine off, relieve the booster of vacuum by pumping the brake pedal three times. Then, apply moderate pressure to the pedal. Start the engine. If the booster is okay, the pedal should drop slightly. If it doesn't, refer to the power brake service procedures in the Service Manual.

If none of your preliminary checks uncovered the source of the high brake effort, continue your diagnosis by checking the vacuum line connections to the brake booster. Look for cracks, restrictions, and proper hose routing (Fig. 11).

Next, check the curb idle speed and timing specifications. Engines that are not set to proper specifications may have enough variance in the carburetor vacuum level to affect brake effort. Refer to the underhood emissions label for the correct idle speed.

With the engine set to specifications, perform a road test. If you determine that high brake effort is still a

problem. check the brake linings. Sometimes grease from the ball joint may contaminate a lining — causing the high effort (Fig. 12). On 1981 and prior year front-wheel-drive cars, grease on the splash shield is a pretty good indicator that grease is on the lining. For 1982, these cars have no splash shields, so inspection for grease contamination is not as obvious and can only be made after the lining is removed.

In either case, if grease is found, you must clean the rotor and install new linings. Mopar Brake and Carburetor Cleaner is an excellent solvent for this purpose. If the car is equipped with power brakes, install the new bonded disc brake linings (P/N 4267348) (Fig. 13). If the vehicle has manual brakes, install the specified manual brake lining replacement (P/N 4205983) (Fig. 13).

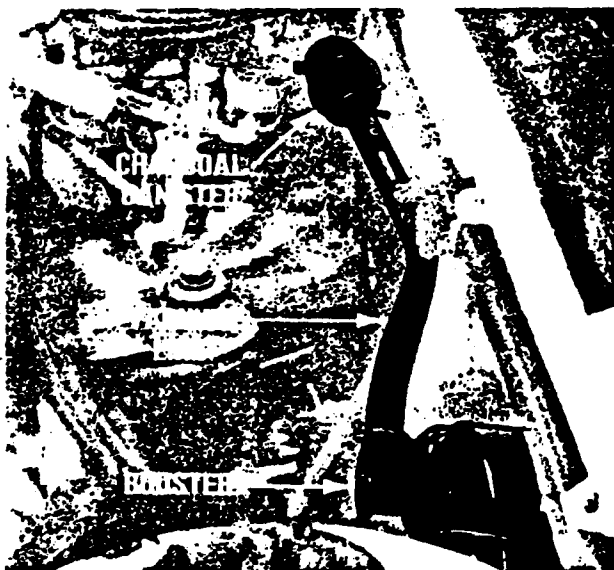


Fig. 11 — Inspect the brake booster vacuum lines for proper routing, cracks, and restrictions.



Fig. 12 — Linings with grease contamination must be replaced.

POWER DISC BRAKE LININGS



MANUAL BRAKE LININGS



Fig. 13 — K Car manual and power disc brake linings are not interchangeable.

3

Diagnosing Excessive Pedal Travel

If the customer complaint is for excessive pedal travel and not high pedal effort, the first check should be for adequate fluid level in the master cylinder. Be sure to clean the master cylinder to prevent dirt from entering the reservoir when removing the caps (Fig. 14).

Next, check for a functioning brake warning light. Begin by turning the ignition switch to the "Run" position and depress the parking brake pedal. If the brake warning light glows, you know the warning light lamp is okay.

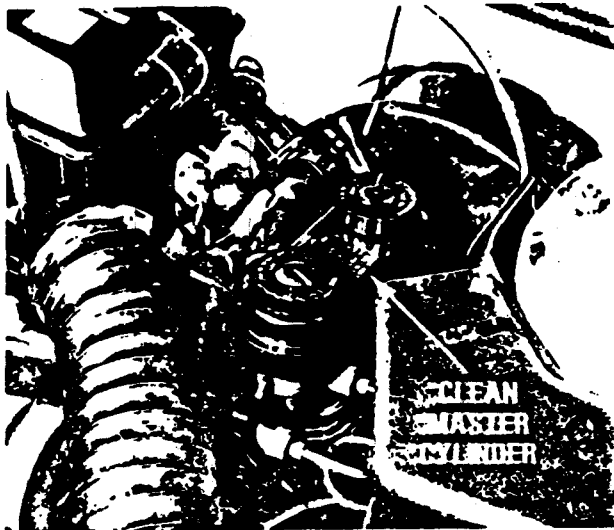


Fig. 14 — The caps and top surface of the master cylinder must be clean before the caps are removed.

Next, release the parking brake and check the connection to the pressure-differential switch (Fig. 15). If the connection looks good, firmly depress the brake pedal. If the warning light glows, there may be a leak somewhere in the system. But if the warning light *does not* glow, the rear brakes will have to be adjusted. Incidentally, the pressure-differential switch is *not* a proportioning valve. There is no proportioning valve in Chrysler's front-wheel-drive brake systems.



Fig. 15 — With the ignition in the "Run" position, depress the brake pedal. If the warning light glows, check the wire connection to the pressure-differential switch.

REAR BRAKE ADJUSTMENT

Even though the rear brakes contribute only 15 percent to the total braking output of a front-wheel-drive car, if they're not adjusted properly, excessive pedal travel may occur.

To properly adjust the rear brakes, both the parking brake and the service brakes must be adjusted. Begin by positioning the car so both rear wheels can turn freely. Remove the adjusting hole cover plug from the brake support plate (Fig. 16). Then, with the parking brake disengaged, back off the parking brake adjusting nut until there is slack in the cable.

Next, insert a narrow flat blade screwdriver into the adjusting nut hole. Tighten the adjuster by moving the screwdriver handle *down* on the *left* side and *up* on the *right* side until both brakes are locked (Fig. 17). Then, back off each adjusting nut six clicks. (Six clicks is a recent revision from the ten-click specification given in



FIG. 16— Use a flatblade screwdriver to remove the adjusting hole cover plug from the brake support plate.

the 1982 Service Manual). Rotate the rear wheels to make sure drag is not excessive.

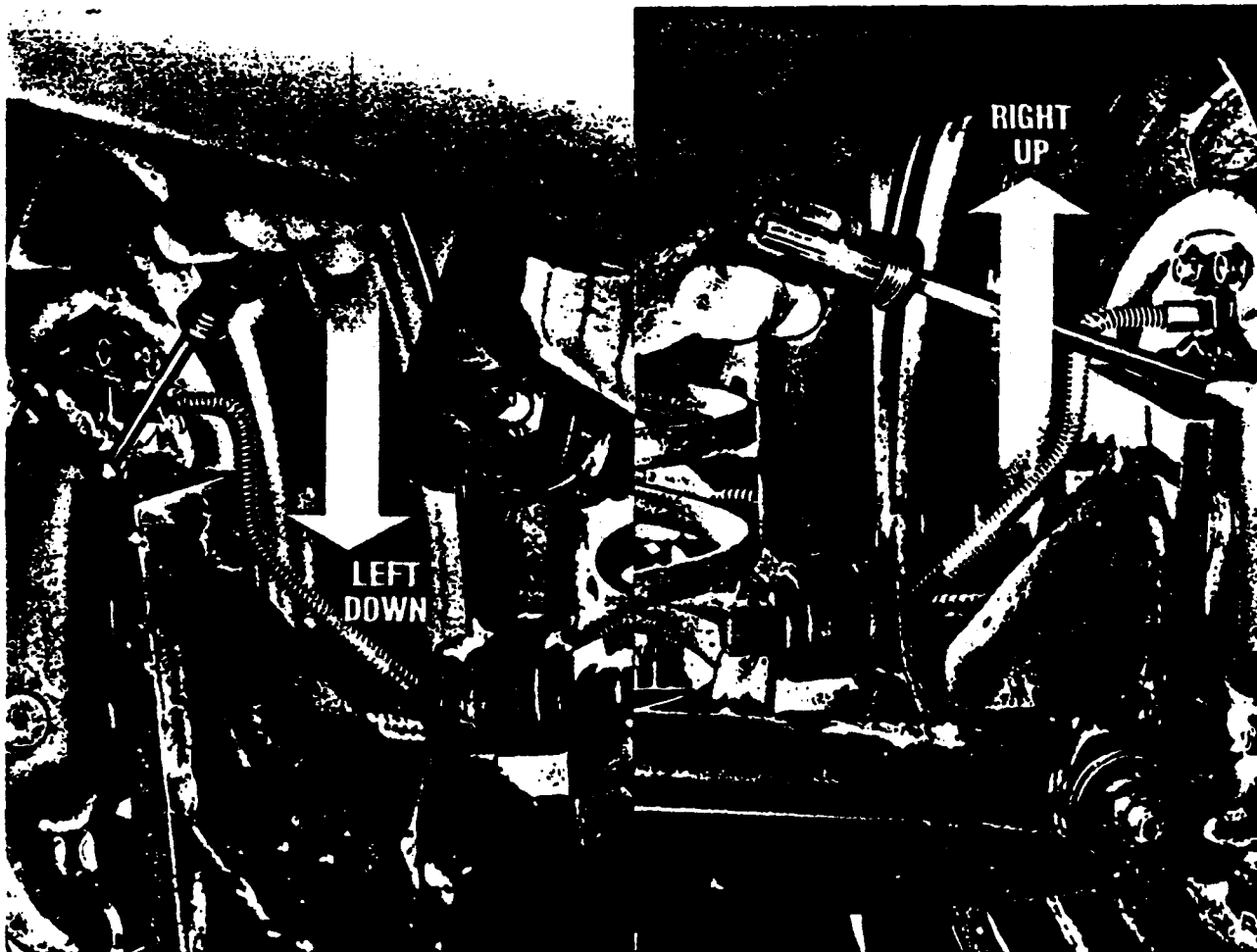


FIG. 17— Tighten each adjuster nut by moving the screwdriver handle *down* on the *left* side and *up* on the *right* side.

Once the adjustment is complete, reinstall the plug. To prevent contaminants from reaching the brake, be sure to apply RTV sealer around the plug and in the return spring holes (Fig. 18).

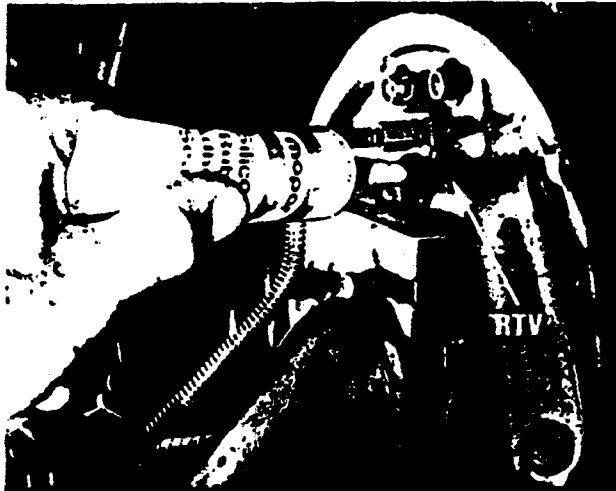


Fig. 18 — After reinserting the cover plug, use RTV to seal the area.

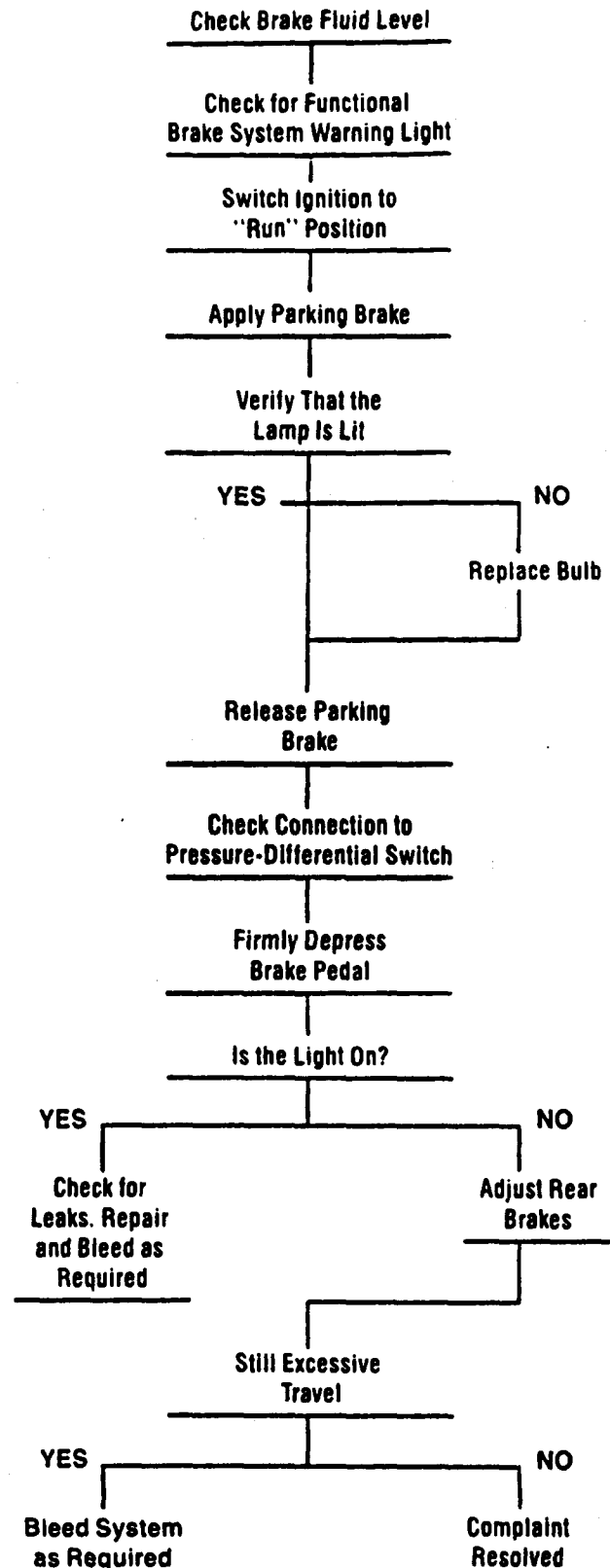
To adjust the parking brake, tighten the cable adjusting nut until you feel a slight drag while rotating the rear wheels. Then, loosen the nut until the wheels turn freely. Now, back off the cable adjusting nut *two* complete turns (Fig. 19). Apply and release the parking brake several times. Then, make sure drag is not excessive at the wheels.



Fig. 19 — To complete the parking brake adjustment, back off the adjuster nut two complete turns.

Recheck the pedal travel. If it is still excessive, air may be trapped in the system and bleeding the brakes is recommended.

EXCESSIVE PEDAL TRAVEL



4 Bleeding the Brake System

The preferred service procedure for bleeding the brake system involves using a power bleeder tank (C-3496B) and master cylinder adapter (C-4578) (Fig. 20).

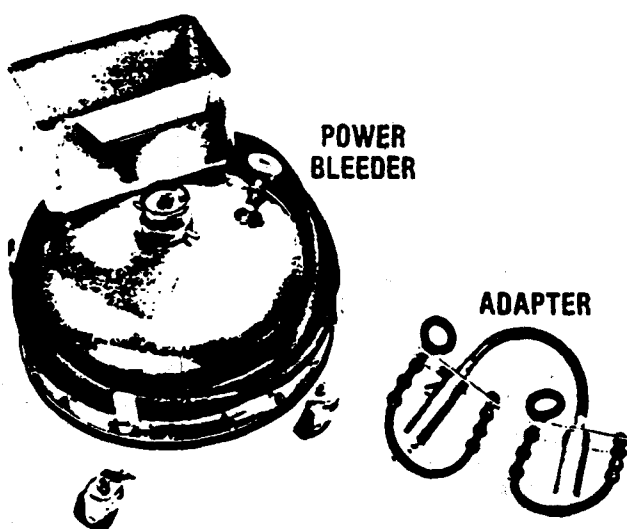


Fig. 20 — To power bleed the brake system, use the power bleeder tank (C-3496B) and adapter (C-4578).

Before removing the reservoir caps, wipe the area clean to prevent dirt from entering the master cylinder. Then, attach the adapter to the master cylinder and strap it into place (Fig. 21). Fill the bleeder tank with clean brake fluid and pressurize it to 35 psi (Fig. 22).

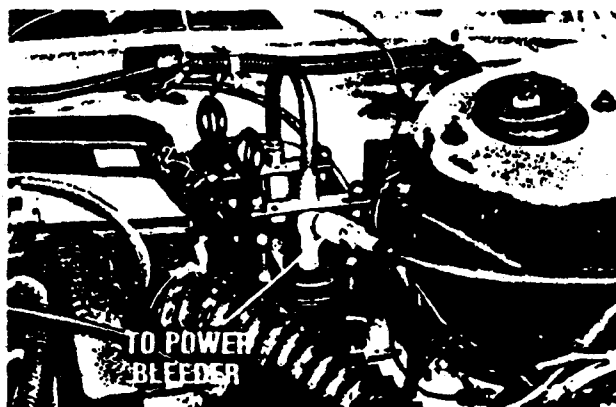


Fig. 21 — Attach the adapter to the master cylinder and strap it securely.

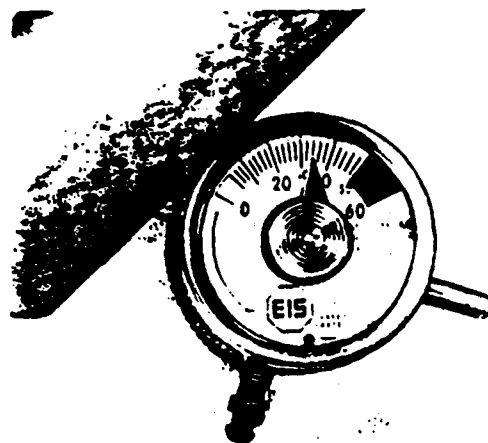


Fig. 22 — Fill the power bleeder tank with clean brake fluid and pressurize the tank to 35 psi.

Next, attach the bleeder tank hose to the adapter nipple and raise the vehicle. Starting at the right rear brake, attach a hose to the bleeder screw and feed it into a clean jar of fresh brake fluid (Fig. 23). Allow the fluid to flow until no bubbles are visible in the jar. Repeat the procedure at the left rear, right front, and finally the left front brake.

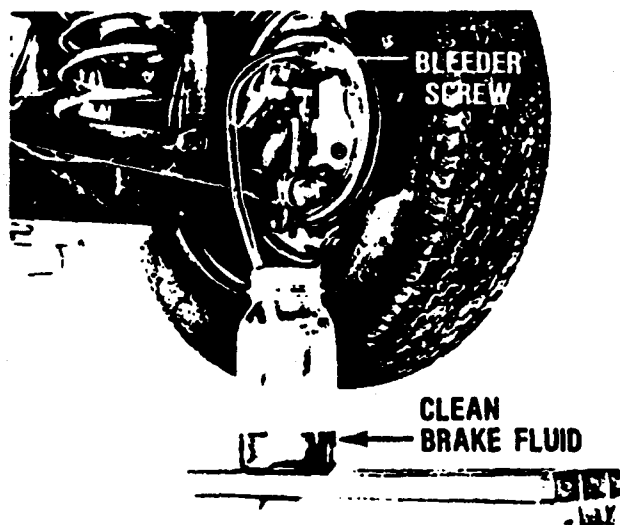


Fig. 23 — Attach a rubber hose to the bleeder screw and feed the hose into a clear jar of clean brake fluid.

Perform a road test to determine that the excessive pedal travel has been corrected.

LOW POSITION BRAKE PEDAL

If the customer complaint is a low position brake pedal (Fig. 24), refer to Technical Service Bulletin 05-03A-81 for the vehicles involved and the correct repair procedure.

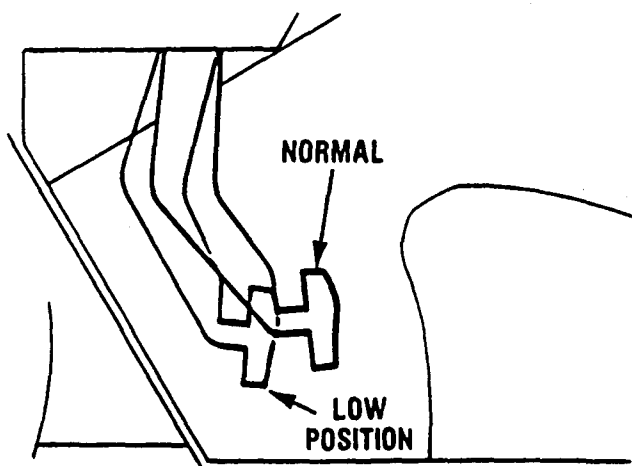


Fig. 24 — Low pedal position can be corrected by following the procedures outlined in Technical Service Bulletin 05-03A-81.



Diagnosing FWD Brake Noises

As we explained earlier, many component and design changes have been made to reduce or eliminate brake system-related noises. However, if you do receive customer complaints about noise, and they seem to be related to the brake system, make the following checks.

FRONT BRAKE NOISES

A rattling sound in the front of the vehicle, that is most obvious when driving over small road bumps, may be

caused by a loose or missing disc brake caliper anti-rattle spring (Fig. 25).

A metallic scraping sound may be related to the front disc dust shield. (These shields are used only on Chrysler's 1981 or prior year front-wheel-drive vehicles.) The shield may be bent and contacting the rotor. Carefully bend the shield clear of the rotor and back to its original position (Fig. 26).

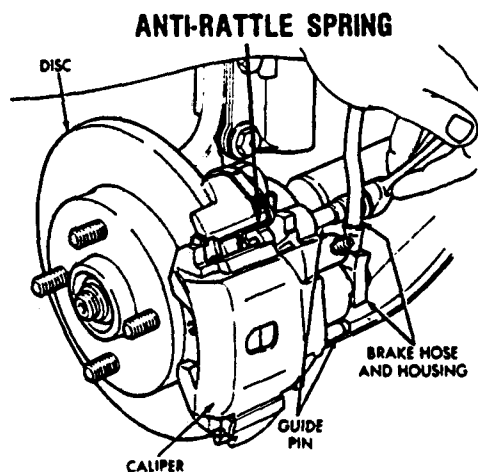


Fig. 25 — Rattling sounds from the front of the vehicle may be caused by a missing anti-rattle spring.

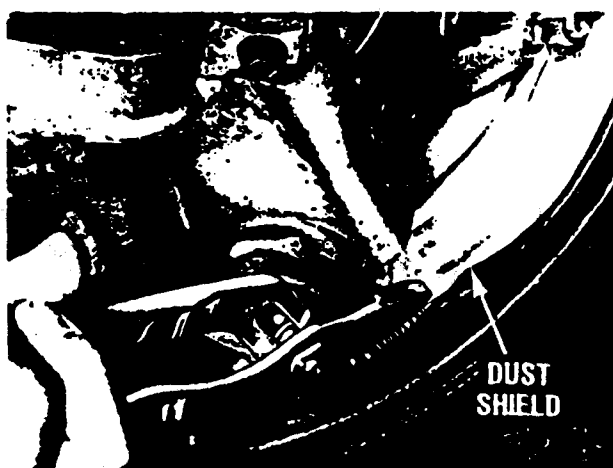


Fig. 26 — A bent dust shield may scrape the rotor resulting in an audible noise.

If the customer complaint is for front disc brake squeal, it can usually be eliminated by greasing the appropriate surfaces of the caliper (See Fig. 9, Page 5.) Be sure to use Mopar Plastilube Grease (P N 1473593). CAUTION: MAKE SURE GREASE DOES NOT CONTACT THE PISTON FACE OF THE INBOARD SHOE, THE RUBBER PIN BUSHINGS, THE RUBBER PISTON-TO-CALIPER SEALING BOOT, OR THE FRICTION SURFACE OF THE BRAKE LINING.

REAR BRAKE NOISE

A metallic scraping sound may be caused by the rear wheel bearing cotter pin coming in contact with the dust cover. Bend the pin to its proper position. Then, re-install the dust cover and check for the sound (Fig. 27).

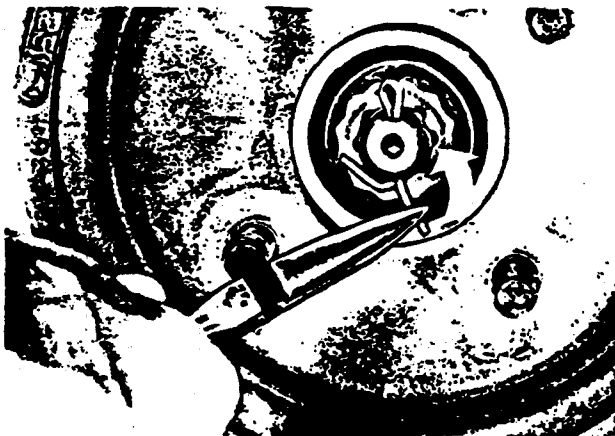


Fig. 27 — A bent cotter pin can contact the dust cover causing a noise.



Fig. 28 — If the parking brake return spring is out of position, simply reposition the spring so it is not in contact with the hub.

Another area to check for scraping sounds is the parking brake cable return spring. It may be in a position where it contacts the rear brake drum hub (Fig. 28). Reposition the spring so it is clear of the hub.

Rear brake howl noise generally occurs at higher mileage or earlier under severe brake usage. It results when factory-applied lubricant is worn away and can be corrected in most cases by cleaning and lubricating the support plate platforms and lower anchor ledges. Clean the platforms with a wire brush and or light sandpaper. Then, lubricate these areas with Mopar Multi-purpose Grease (P N 2932524 or P N 2468492) (Fig. 29). Take care to avoid getting any grease on the rubbing surface of the lining or drum. Particular care should be taken to lubricate the lower anchor behind the guide plate where the shoes contact the anchor plate.



Fig. 29 — Rear brake howl can be corrected by wire brushing and greasing the shoe platforms and anchor ledges.

After reassembling the brake, be sure to perform the complete rear brake adjustment procedure as outlined on page 9.

SUMMARY

Your customers expect and deserve responsive and reliable brakes. You'll find the diagnostic and service procedures outlined in this session, and your Service Manual will give you the necessary information to keep your customers' brake systems performing satisfactorily.

Finest brakes in the industry! . . . Chrysler and Imperial

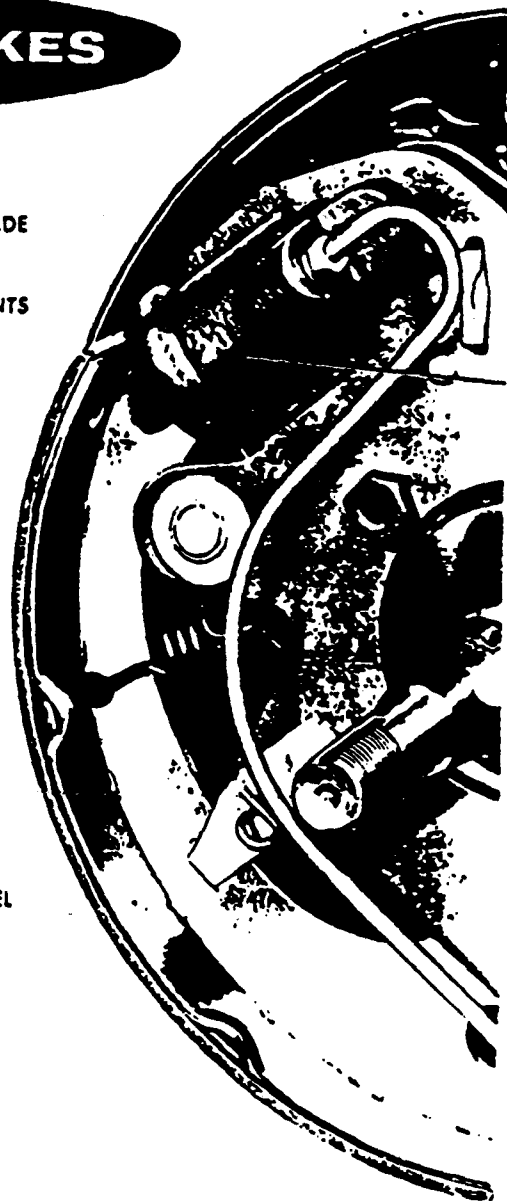
TOTAL-CONTACT BRAKES

- FAST STOPS
- LESS PEDAL PRESSURE
- PREDICTABLE BRAKING ACTION
- GREATER RESISTANCE TO FADE
- LONG LIFE
- FEWER PERIODIC ADJUSTMENTS

Chrysler and Imperial Total-Contact brakes have proved their superiority over competitive brakes in test after test. Even with emergency "panic" stops, Total-Contact brakes stopped faster and held the car in a straighter line. Under induced brake fade conditions, Total-Contact brakes retained excellent stopping ability when competitive brakes faded out severely.

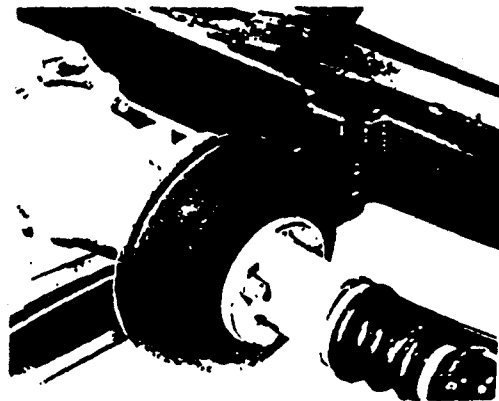
These Chrysler and Imperial brakes, unlike competitive brakes, bring the entire brake lining area into uniform contact with the brake drum with uniform pressure. Also, Total-Contact brakes have more brake lining area than competitive brakes. The total result is unequalled performance in fast, smooth, predictable braking. In addition, Total-Contact brakes require less pedal pressure for any given stop than competitive brakes. From the economy standpoint, these brakes are unsurpassed in the industry for long life combined with the need for fewer periodic adjustments.

FRONT WHEEL
BRAKE



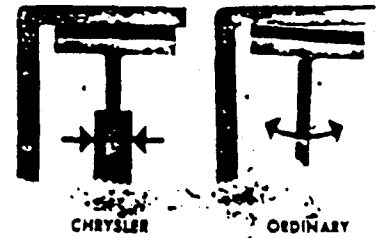
● GREATER SAFETY

The Chrysler and Imperial parking brake is mounted on the drive shaft and is independent of the service brakes. It is the most powerful in the industry, with three times the effective lining area of competitive parking brakes. Thus, the Chrysler and Imperial transmission needs no locking device for parking safety. Competitive parking brakes consist of a lever connected with one shoe in each of the rear service brakes. That's why most competitive cars need a parking position on the transmission selector.



TWO SUPPORT PLATES hold brake shoes in alignment for total, instantaneous contact of lining and drum surface.

ORDINARY BRAKE ASSEMBLY has no support plates. Shoe is free to tilt. Time is needed for hydraulic pressure to straighten out shoe. The result is slower, unpredictable stops and uneven lining wear.



FLEXIBLE WEBS in the brake shoe, exclusive with Total-Contact brakes, compensate for normal, slight changes that take place in the roundness of the brake drum when brakes are applied. This means uniform contact between all of the lining area and the drum.

ORDINARY BRAKES have inflexible webs that do not compensate for distortion of the brake drum. Thus, the result is uneven braking pressure, loss of braking power, and uneven wear. Flexible webs are a big factor in the ability of Total-Contact brakes to resist brake fade.

TWO CYLINDERS at each front wheel, exclusive with Total-Contact brakes, provide more braking power up front where it can be used to advantage. This extra stopping power takes advantage of the normal shift of weight forward when the car stops - which increases front-wheel traction. Braking action is divided evenly between the shoes at each front wheel, for even lining wear.

COMPETITIVE FRONT BRAKES have one cylinder. Servo action is used to actuate the secondary shoe. The primary shoe does about 20 percent of the braking work, while the secondary shoe does about 80 percent. Not only is the braking action unpredictable, but linings must be replaced as soon as the fastest-wearing lining is worn down.

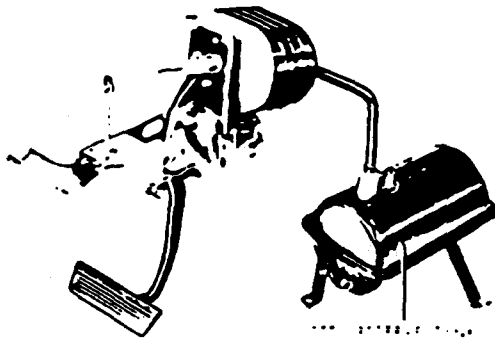
CHRYSLER AND IMPERIAL CYCLEBOND BRAKE LINING is bonded to the brake shoe. Thus, it may be used for almost its entire thickness. Since rivet holes and beveled ends (used in competitive cars) are eliminated, there is more working brake lining area and linings last far longer. Rivet holes in competitive linings can collect abrasive grit and score brake drums.



• SAVE EFFORT • GREATER SAFETY

Chrysler and Imperial power brakes provide 72 percent of the pedal effort needed for braking. Because the pedal travel is shorter than with standard brakes, braking is faster. Chrysler and Imperial power brakes require considerably less pedal effort than competitive power brakes. A safety reserve tank provides an air vacuum for several normal stops in case the engine should stall.

Standard equipment on Saratoga New Yorker 350 E and 350 E.



Product Planning

ROSS ROY

DATA

BOOK

COMPANIES

ESSENTIAL

LETTERS

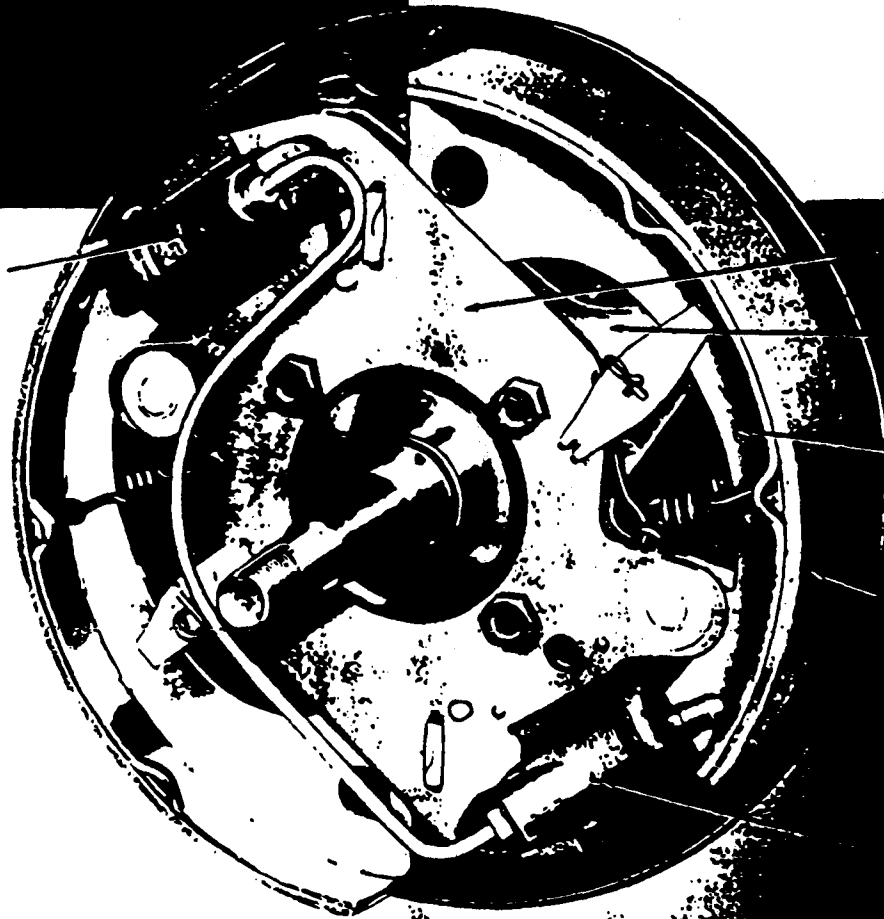
produced by an independent organization that has been
compiling and publishing
information about automobiles since 1926...



CHRYSLER TOTAL- CONTACT BRAKES

for quick, safe, smooth stops
and long, trouble-free service life

UPPER
CYLINDER



Total-Contact brakes are the only volume-produced automatic brakes to bring the entire brake drum into contact with the brake shoes. This, plus the fact that the shoes are made of a special alloy, give Chrysler more stopping power than any other car in its class. And, because the brake shoes are made of a special alloy, they provide predictable braking action. What's more, if the shoes are worn, they are needed for any kind of repair. Total-Contact brakes. Total-Contact is the answer to the industry for stopping power with less need for parts.

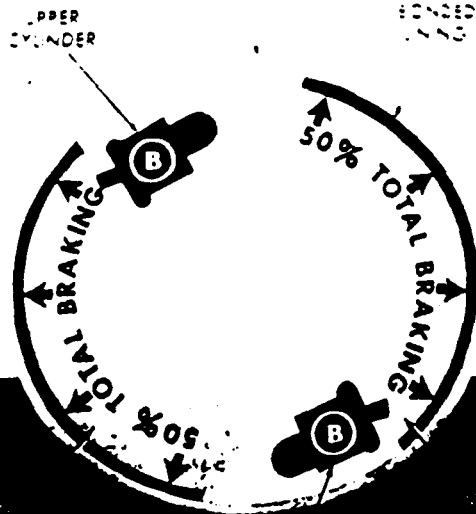


FIG. 1—CHRYSLER FRONT BRAKE

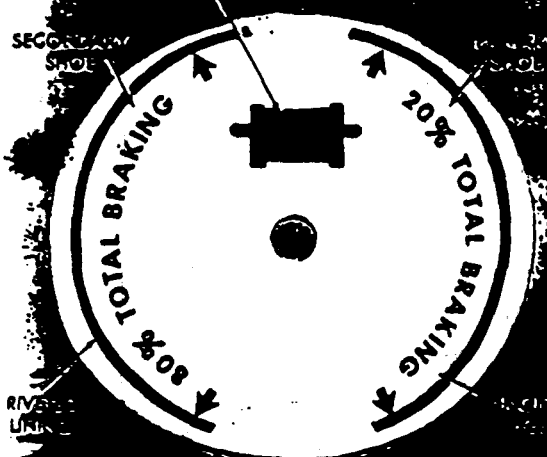
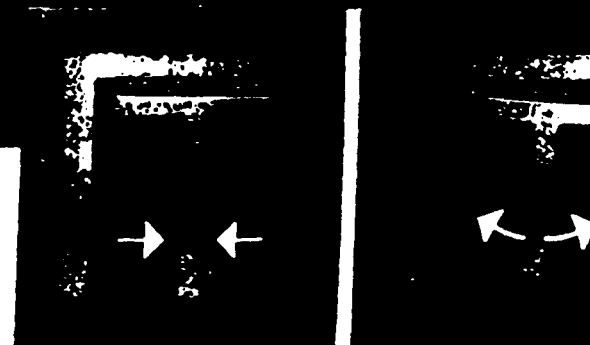


FIG. 2—COMPETITIVE FRONT BRAKE

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Chrysler support plates hold brake shoe in alignment.

Ordinary brake lacks support plates; shoe is free to tilt.

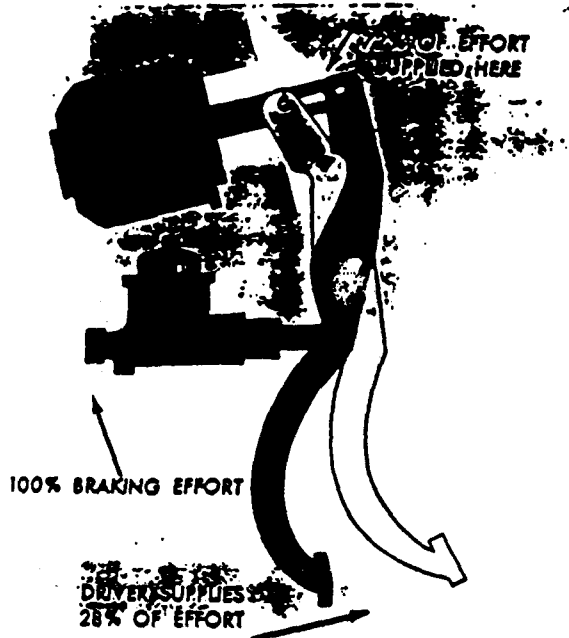
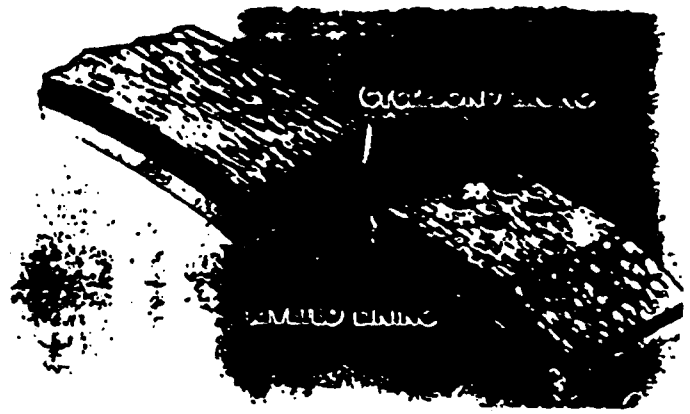
Flexible webs (see Figure 1) are specially designed to flex so that they compensate exactly for normal, slight changes in the degree of roundness of the brake drum when brakes are applied. This maintains uniform contact between all of the lining area and the drum. Ordinary brakes have webs that do not compensate for distortion of the brake drum. This makes for uneven pressure, loss of braking power and uneven wear.

Two cylinders in Chrysler's front brakes (see B in Figure 1) put more braking power up front to take advantage of the forward shift of weight that occurs when a car stops. Actually, front brakes on Chrysler do about two-thirds of the work of braking. Each of Chrysler's front brake shoes has its own cylinder and anchor. This divides the work of braking evenly between each shoe, so each does 50 percent of the total.

Competitive front brakes have only one cylinder, using a servo action to actuate the secondary shoe. The effect is that the primary shoe does 20 percent of the total braking, while the secondary shoe does 80 percent. This results in uneven lining wear and unpredictable stops.

Chrysler bonded-type brake lining

Cyclebond lining requires no rivets, thus it is usable for almost its entire thickness and not just to the rivetheads. Rivet holes and beveled ends are eliminated, which means longer life and less brake drum damage from abrasive grit.



Chrysler power brakes reduce pedal effort

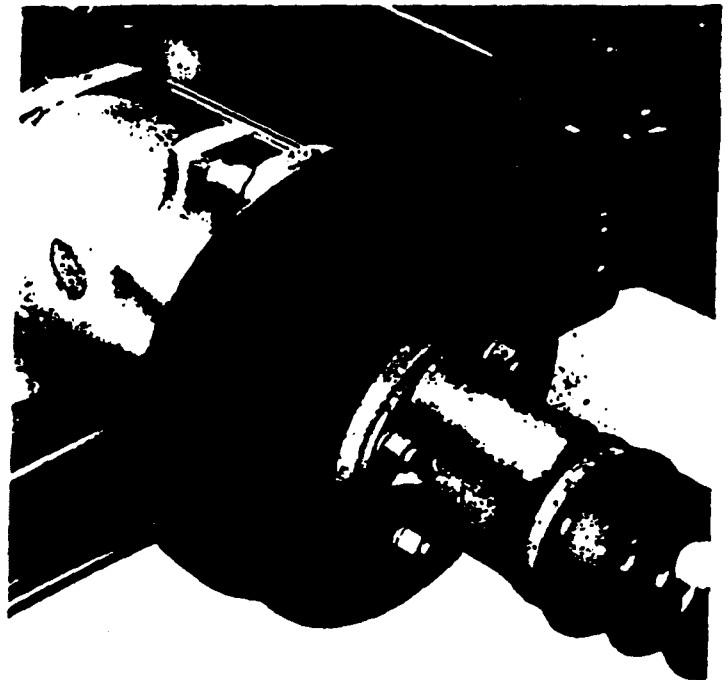
This simplified diagram shows how the vacuum-operated power brake unit supplies 72 percent of the required pedal pressure for braking. Only 28 percent need be applied by the driver. Shorter pedal travel than with standard brakes provides easier braking in an emergency. Response is controlled so that a panic stab on the pedal will not cause brakes to lock. Pedal effort required for Chrysler power brakes is considerably less than with competitive power brakes.

In case the engine should stall, a safety-reserve tank supplies enough vacuum for several normal stops. After that, the pedal linkage will function as in cars without power brakes. The only difference is that with the power unit not operating, more pedal pressure is needed.

Chrysler independent parking brake

Mounted on the drive shaft and completely independent of the service brakes, Chrysler's independent parking brake is the most powerful in the industry. It has three times as much effective lining area as competitive parking brakes. Competitive parking brake is merely a lever connected to one shoe of the rear service brakes. That's why most competitive cars have a parking position on the transmission selector, which Chrysler does not need.

Only Chrysler, in its field, provides the protection specified by the National Commission of Safety Education for school buses which says: "Auxiliary brake shall be provided in addition to service brake, and shall be an entirely separate, mechanically operated brake."

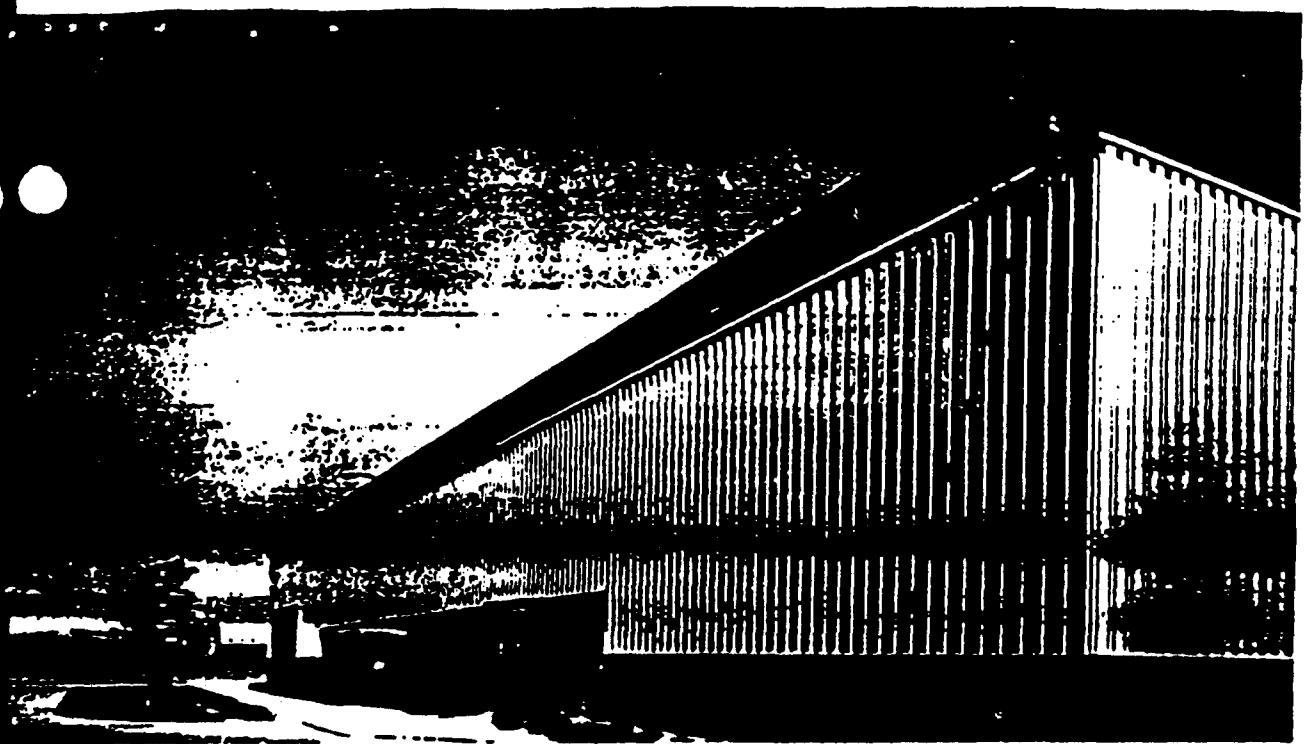


CycleWeld
brake linings

**for the
aftermarket**

CycleWeld
PRODUCTS

THE CYCLE WELD DIVISION  **ALBANY, N.Y.**



Cycleweid linings are produced in this plant which was designed and built specifically for the manufacture of friction materials.

a research-created lining for Rebonding Shops

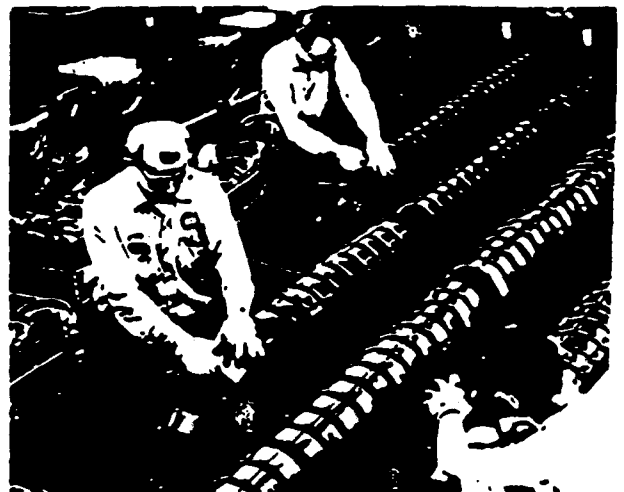
Cycleweid brake linings were originally developed for use on new Chrysler-built cars. Now with the attainment of full production in the new brake-lining plant of the Chemical Division, these linings — incorporating the most advanced knowledge about friction and braking requirements — are available as replacement sets for virtually all makes of cars.

Produced in three grades, and in sizes engineered to cover virtually all O.E.M. specification sizes, Cycleweid aftermarket linings are designed to:

- Give maximum friction, yet smooth, even braking.
- Distribute the friction uniformly over the braking surface.
- Maintain that friction with minimum fade as the brakes heat.

Production bonding of Cycleweid linings to brake shoes.

- Minimize objectionable noises.
- Give a good "pedal feel" — an intangible human response related to driver control and ability to judge deceleration rate.
- Give long-lasting brake life.
- Provide excellent bondability when bonded with leading brake-bonding adhesives.
- Operate smoothly, even in wet weather.



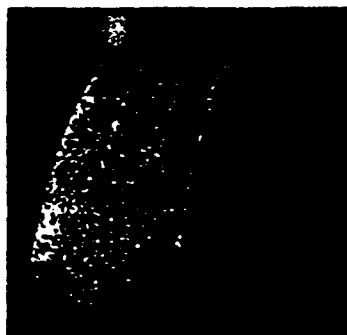
the Cycleweld Aftermarket Line

The three grades of Cycleweld linings — all of Chrysler quality — give the rebonder complete coverage of all markets — from the most discriminating to the economy-conscious. They are designated as follows:



Cycleweld 300

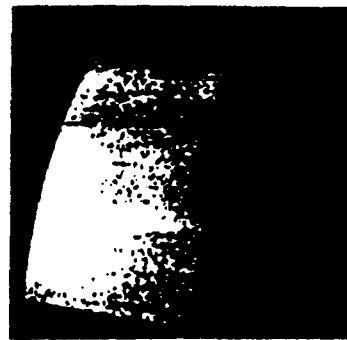
This premium-grade lining is recommended for late-model cars and applications where original-equipment quality and performance are prime considerations. Superior binders and friction modifiers give it exceptional heat stability and long-wearing characteristics. Lining segments are supplied for all brake systems.



Cycleweld 200

This high-quality lining is recommended for use where competition is keen and the customer is price-conscious. It exhibits good heat-resistant characteristics and has the pliability to permit a less critical tolerance in shoe alignment and other adjustment problems

encountered in relining. The lining has medium-high frictional properties and gives quiet, smooth braking action, coupled with long life. Segments are made for all brake systems.



Cycleweld 100

This is a standard-grade lining, recommended for older vehicles and cars not subject to hard usage at high speeds. The most economical of the three, the lining has medium-high frictional properties and gives quiet, smooth operation and long life. Semirigid segments are made for all brake systems.

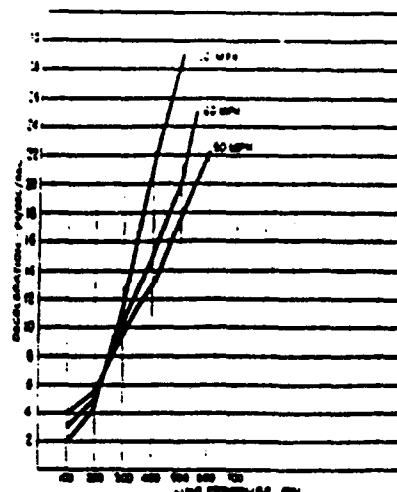
Cycleweld linings — in all grades — are sized as properly fitting replacement sets for original equipment. Segments are carefully identified for easy, errorless installation. When desired, linings are supplied precoated with bonding adhesive.

characteristics of Cycleweld Linings

Cycleweld aftermarket linings are designed to give maximum braking performance on the car and the highest production efficiency in the reponder's shop. They feature uniformity in respect to density, frictional characteristics, hardness, and moisture impermeability throughout the lining area and from one lining to another. The coefficient of friction of all three grades is designed to give optimum smoothness in braking action. The accompanying graphs show typical deceleration and fade and recovery curves from instrumented road tests.

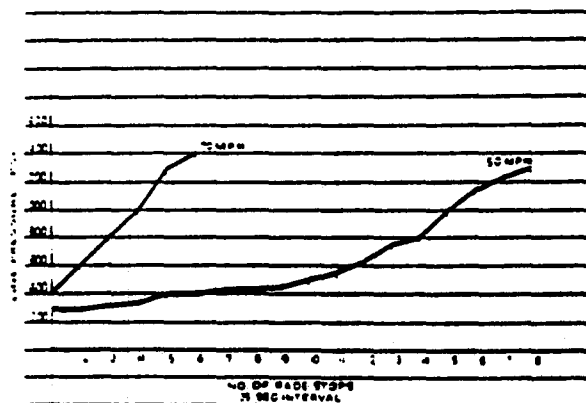
The high density of Cycleweld linings means that they are resistant to moisture and, thus, recover braking effectiveness quickly after a car has been driven through water. The controlled hardness and toughness of the linings enable them to be handled ruggedly in the bonding shop without chipping or breaking - thus eliminating shop losses and cutting the scrap rate to practically zero. All Cycleweld linings are excellent for adhesive bonding.

BRAKE EFFECTIVENESS



These curves show a typical brake-effectiveness test on a car using a Cycleweld aftermarket lining. The stable, high friction provides uniform driving "feel", with very little spread at the various speeds and with a minimum high-speed slipaway.

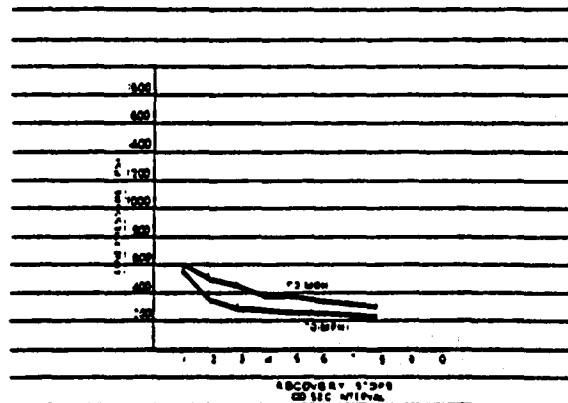
FADE RESISTANCE



Fade Stops made at 15 ft. sec.²
Interval Between Stops - 25 secs.

The ability of a Cycleweld aftermarket lining to withstand the effects of repeated high-speed stops is illustrated. The test, performed on a car loaded with 600 pounds of weight, demonstrates that the lining maintains good frictional properties even after severe treatment.

RECOVERY AFTER FADE



Recovery Stops Made from 40 MPH at 15 ft. sec.²
Interval Between Stops - 100 secs.

The recovery characteristics of a Cycleweld lining are shown by these data. Immediately following the fade tests at 70 mph and at 40 mph, these 40-mph recovery stops were performed to determine how rapidly the linings recover to the original friction level. Rapid recovery, with straight-line stops and no diving or pulling, is typical of Cycleweld aftermarket linings.

how Cycleweld Linings are made

Cycleweld linings are produced in a plant designed and built specifically for the manufacture of friction materials. The most modern equipment and procedures are used, and the production capacity is in excess of five million linings per month.

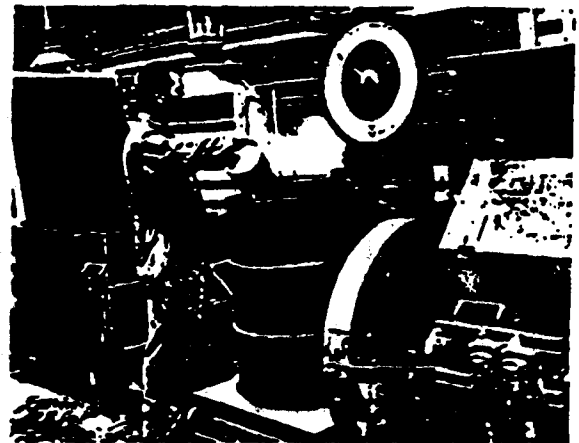
Quality control is exacting, beginning with laboratory approval of all raw materials and including ten other checkpoints before final inspection. Print-weighting equipment is used to assure uniform quality of batches of lining mix.

Rigid standards are imposed for the materials used in making Cycleweld linings. Only high-grade Canadian asbestos meets the standards. Solvents, binders, and

other materials are high-grade, and each must pass a quality-control check.

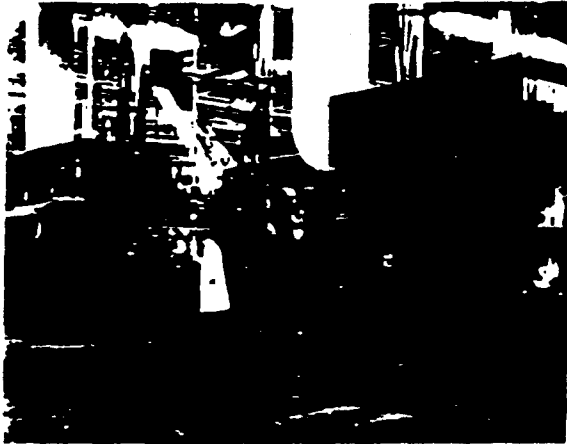
The Chemical Division, as a matter of customer policy, maintains at all times a sizeable inventory of the linings used by its customers. The inventory provides the ability to make prompt shipment on customer orders.

All Cycleweld segments are marked with FMSI part numbers, assuring positive identification in the bonding shop. To help prevent damage in snipping, containers are custom-made for different sizes. Shipping is by select carriers to assure prompt service.



Left - Receiving raw materials.

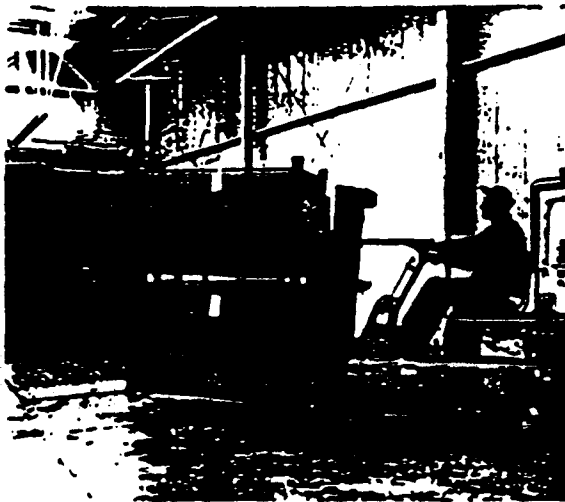
Above - Making a weigh-out of brake-lining ingredients.



A battery of ovens for the precision curing of Cycleweld linings.



Preparing OEM linings for shipment to Chrysler automotive plants.



Loading truck for shipment to a bonding shop.



One of the final operations is the finish grinding to specified dimensions.

technical service back-up

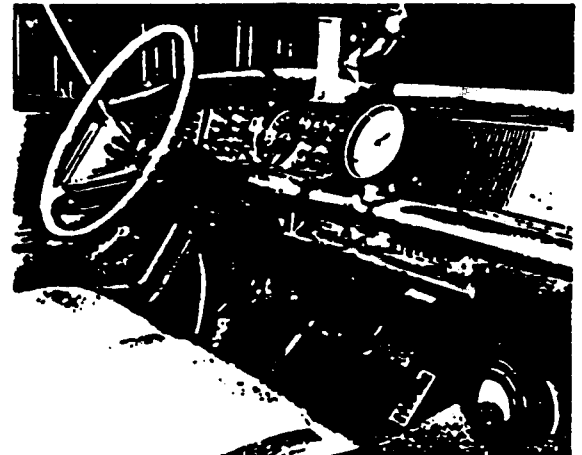
The distributor or rebonder of Cycleweld linings is supplied with all the data needed for the expedient distribution or use of the segments. The printed literature includes:

- "Automotive Brake Lining Data", published by FMSI (Friction Materials Standards Institute, Inc.). This reference enables the accurate determination of segment sizes for all cars.
- "The FMSI Brake Shoe Identification Catalog" - a reference especially valuable to the rebonder.
- Interchangeability lists of linings - useful in minimizing investment in inventory.
- Specifications for lined brake-shoe sets. These give the FMSI bonded set number; the type of brake; the

shoe number; primary reverse and secondary forward; the lining segment to use by grade; segment dimensions; segment position; and grinding specifications.

Where requested, the Chemical Division will also give complete instruction in brake-shoe cleaning, inspection, priming, and adhesive-bonding operations. The Chrysler Corporation was the originator of bonded brake linings, and the Chemical Division is a major manufacturer of brake-bonding adhesives. Such instruction is also supplemented by in-shop advisory service by Cycleweld engineers on bonding problems.

The laboratory and testing facilities of the Chemical Division are also available for helping customers. The rebonder may, for instance, wish to have a modification made in the linings to meet a specific requirement. Or a customer may wish to color-code for identification of his brake sets. In either case, the feasibility of the desired changes can be determined in the Division's laboratory.



A specially instrumented car used to test Cycleweld brake linings at the Chrysler Proving Grounds Test Track.

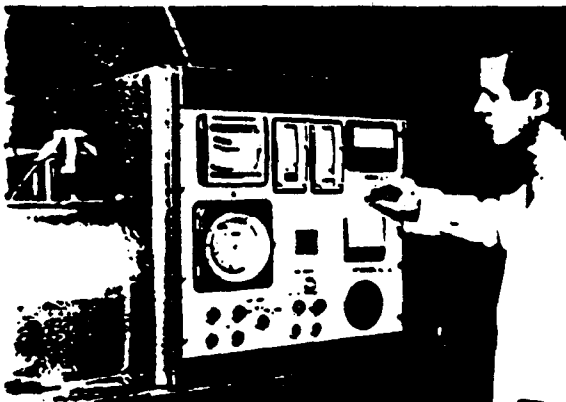
research and development

Brake-knee and lining assemblies, just as all other components of automobiles, must be integrated with the whole mechanism. This means that engineering changes in linings must be made with changes in the weight and horsepower of automobiles and new brake, wheel, and tire designs and sizes.

The Chemical Division maintains a constant research program to keep Cycleweld linings advanced technically. Linings produced with innovations designed to meet changes in the automobile or service conditions are tested not only in the laboratory, but also at the Chrysler Proving Grounds Test Track. Trained test drivers, following O.E.M. procedures, gather performance data with virtually all makes of cars, including foreign. Tests are run at the 4,000-acre Chrysler test track under a wide range of terrain and weather conditions. The test cars are instrumented for measuring deceleration, line pressure, and temperatures of shoes and linings so that meaningful data are obtained and human judgement as to performance minimized.

No Cycleweld aftermarket lining is approved for manufacture - whatever the grade - without thorough testing in accordance with SAE J661⁽¹⁾ and J843⁽²⁾ test procedures. This is the best assurance possible of satisfactory performance.

- 1: Brake Lining Quality Control Test Procedure
- 2: Brake System Road Test Code - Passenger Car



A Chase dynamometer tests lining sample for friction characteristics under various speeds, temperatures and loads.

The laboratory equipment used in development work ranges from bench-scale simulations to full-scale automotive tests. The personnel assigned to R&D studies on brake linings include people with as much as thirty years of experience in the formulation, testing, and manufacturing of friction materials.

The Chemical Division is a member of the Friction Materials Standards Institute, Inc., and also of the Adhesive and Sealant Council. Individual members of its research staff are affiliated with the American Society for Testing Materials, the Society of Automotive Engineers, the American Chemical Society, and various other technical organizations.



Checking the hardness of a cured lining with a Rockwell Hardness Machine.



Visually inspecting brake linings after a track test.

sales back-up

The Chemical Division, naturally, wants its customers to be successful - and will go to great length to help distributors and users of Cycleweld linings with their marketing programs.

In many instances, the Division can aid customers to pinpoint markets - develop promotion and advertising programs - design displays and packaging. Cycleweld representatives - selling and servicing a variety of automotive products - are in the field constantly, and what they learn about aftermarkets can be of direct sales value to handlers of Cycleweld linings.

The Chemical Division is service-oriented in its approach to customer relations - which means it is always ready to supply every help possible. Communications are easy - and the size of the Cycleweld sales and technical service force assures that competent personnel are always available to receive the customer's request and act on it promptly.

about the Chemical Division...

The Chemical Division, Chrysler Corporation, is a manufacturer of some 300 chemical formulations used by industry. These include not only various types of brake linings, but also the adhesives and shoe primers used by O.E.M. and rebonding shops for brake-shoe bonding.

The Division was the originator of adhesives for structural bonding, and the Cycleweld trade name—now used for all its products—was derived from the concept of "welding" materials together with a thermosetting adhesive through a "cycle" of heat, pressure, and time. The first bonded brakes in Chrysler cars were fabricated with

Cycleweld adhesives—the modern versions of which are now preferred by numerous bonding shops.

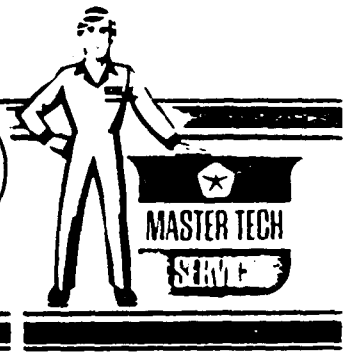
Brake-lining production was begun at the Chemical Division following an extensive program of fundamental research on friction phenomena and the characteristics of ideal braking materials. Originally, the Division supplied the O.E.M. and replacement needs for the Chrysler Corporation. When a new brake-lining plant at Trenton, Michigan, went into operation in 1965, the Division had the needed capacity to produce linings for the aftermarket as well as for original-equipment manufacturers.



NOVEMBER

MASTER TECH

82

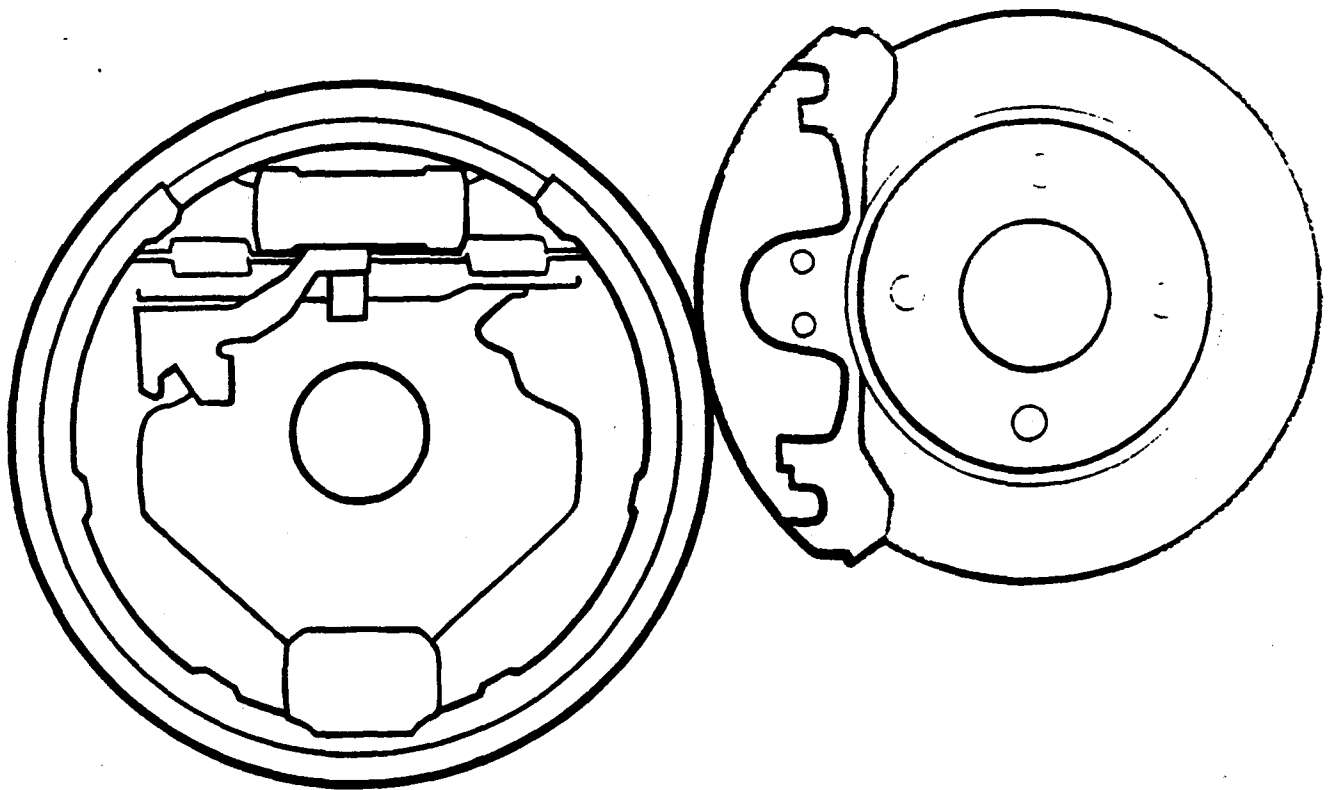


SERVICING 1983 FRONT-WHEEL-DRIVE BRAKE SYSTEMS

SERVICE AND PARTS OPERATIONS



**CHRYSLER
CORPORATION**



Quiet...Responsive...Durable... Chrysler Brakes for 1983.

Yes, Chrysler brake systems are quiet, responsive, and durable for 1983.

In this month's MASTER TECH training session, we will demonstrate the various techniques for diagnosing and servicing the front-wheel-drive power brake systems.

Beginning with a discussion on the description and operation of the brake actuation system, the training session will present a step-by-step diagnosis of the system by using the two most common customer complaints — "spongy pedal" and "pedal goes to the floor" — as our

diagnostic problems. New disc and drum brake service procedures are also presented in this Reference Book. Each of these sections highlights particular service tips that are applicable to the 1983 brake system, which should be of interest to many of you.

In this session, we will explain all the changes in the brake system that you'll need to know to keep your customers' brakes performing properly.

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We support
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Mechanic's Certification

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1 Brake System Description and Operation

For 1983, every front-wheel-drive car and truck uses a diagonally split power brake system. The primary hydraulic circuit activates the right front disc brake and the left rear drum brake, while the secondary circuit controls the left front and right rear brakes (Fig. 1).

Although this kind of brake system is familiar to many of you, some of its components are new and reflect significant technical advances for this year.

The power brake actuation system (Fig. 2) has been completely redesigned this year to provide our customers a more responsive brake pedal feel.

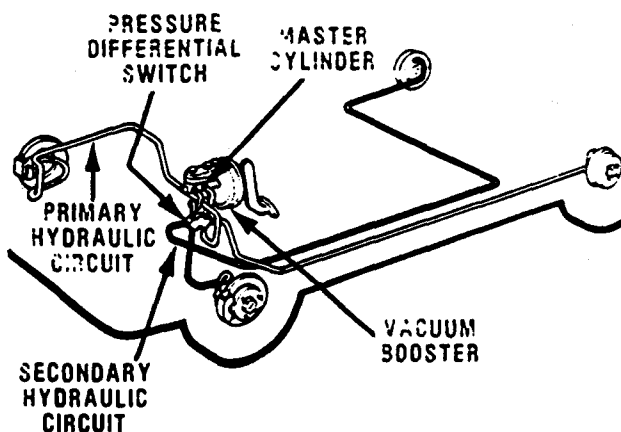


Fig. 1 — Brake line routing of the diagonally split brake system.

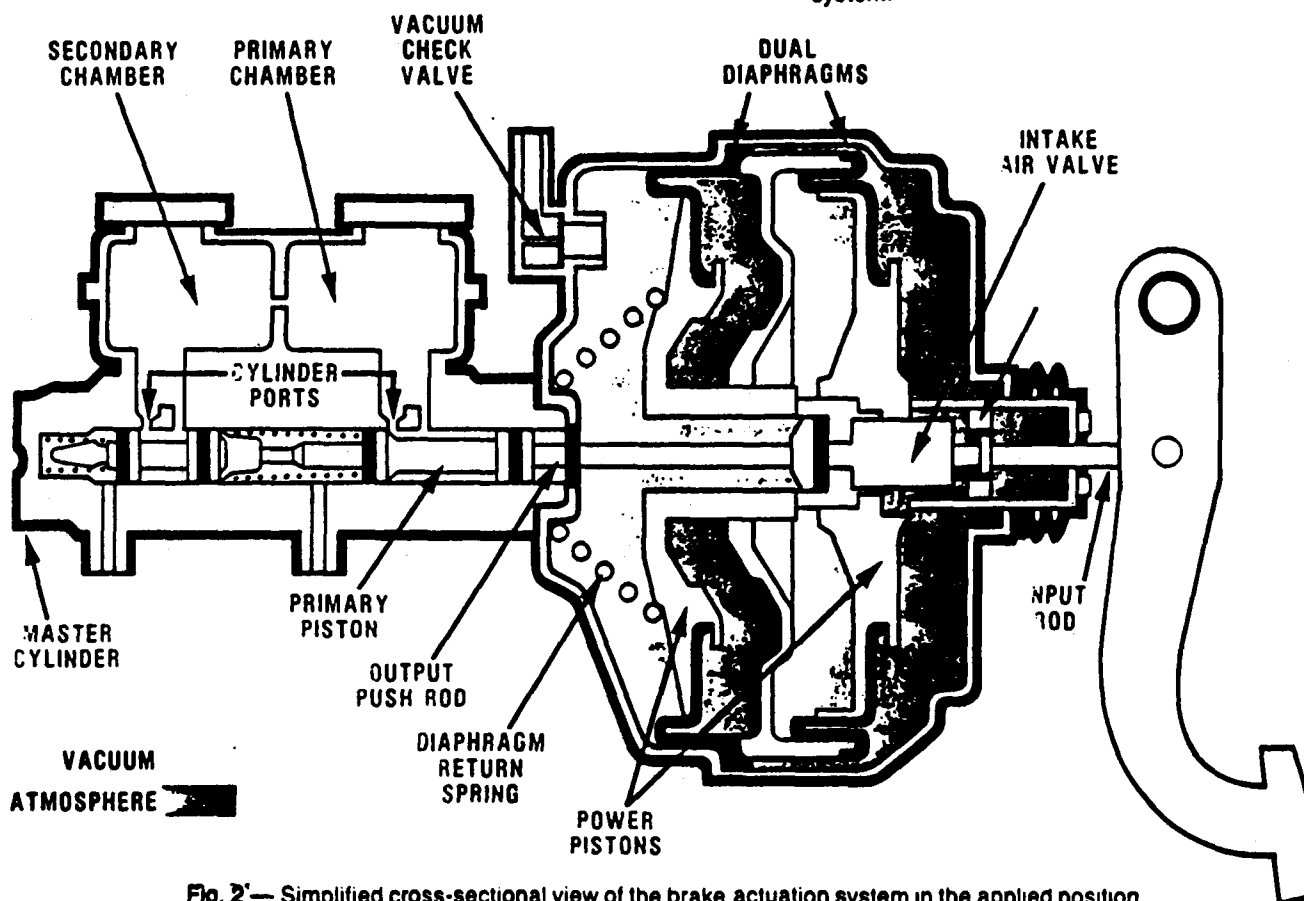


Fig. 2 — Simplified cross-sectional view of the brake actuation system in the applied position.

MASTER CYLINDERS HAVE CHANGED

One of the most notable changes for this year has occurred in the aluminum tandem master cylinder (Fig. 2).

It has an all-new aluminum casting with new internal parts. This master cylinder has a smaller 21-millimeter bore and a longer stroke. The smaller bore generates higher hydraulic line pressure, and the long stroke provides more fluid displacement.

SOME BOOSTERS ARE BIGGER

In addition to a new master cylinder, a larger, more powerful dual diaphragm vacuum booster is used on many front-wheel-drive vehicles. This booster (Fig. 2) increases the brake application force with less pedal effort than on earlier model vehicles.

HOW DOES THE SYSTEM OPERATE?

Now let's see how this improved actuation system works (Fig. 2). With the brake pedal in the released position, the diaphragm return spring holds the booster's output push rod and air intake valve against its seat. This opens the vacuum control port but closes the atmospheric port.

With the engine running, equal levels of vacuum are applied to each side of the two diaphragms to hold the booster's power pistons in suspension, so that the booster assembly does not apply force to the master cylinder.

As the brake pedal is depressed, the booster's input rod and air intake valve move forward to seal off the vacuum port. As the air intake valve unseats, atmospheric pressure enters the booster to create a pressure differential between the vacuum side and the atmospheric side of the dual diaphragms. The pressure differential helps force the booster's output rod against the master cylinder's primary piston assembly. When the pistons move forward, they close off the cylinder's ports to create brake fluid pressure. The pressure is then transmitted to the brakes.

During a full brake application, more atmospheric pressure is admitted behind the booster's dual diaphragms until all the power assist from the booster has been used. The maximum assist point is called *booster runout*, and it is felt as a definite hardening of brake pedal effort. After booster runout is reached, the input rod directly transmits any increase in brake pedal effort to the master cylinder.

THE SYSTEM'S LIGHT SWITCH

Another component in the diagonally split power brake system is the pressure differential brake warning switch (Fig. 3).

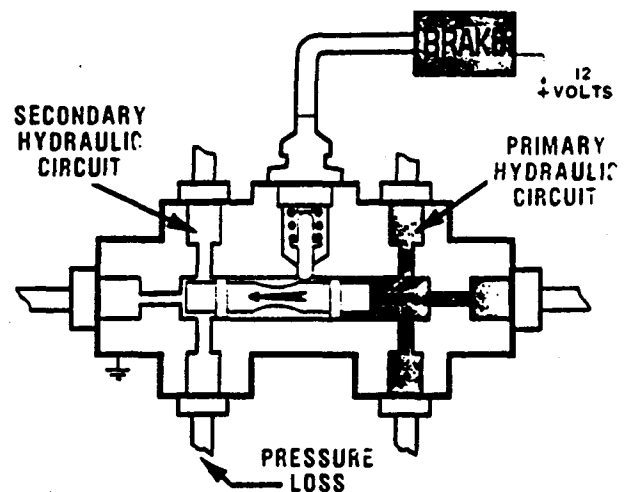


Fig. 3 — Pressure differential switch and brake warning light.

Its only function is to turn on the brake warning light when there is a loss of hydraulic pressure in the failed half of the brake system.

For example, if there's a hydraulic pressure loss at the left front disc brake during a brake application, it creates a pressure differential at the forward side of the switch, causing the differential piston to shuttle toward the failure. This turns on the brake warning light.

2 Brake Actuation Diagnosis

Experience has shown that the two most common customer complaints about any brake system are a "spongy brake pedal" and a "brake pedal that goes to the floor."

TESTING THE WARNING LIGHT CIRCUIT

The first step in diagnosing the brake actuation system is to test the brake warning light. To do this, turn the ignition key to the ON position and apply the parking brake.

The brake warning light should turn on to indicate that the circuit and bulb are okay. Releasing the parking brake should turn off the warning light.

Next, check the brake warning light wire leading to the pressure differential switch (Fig. 4).

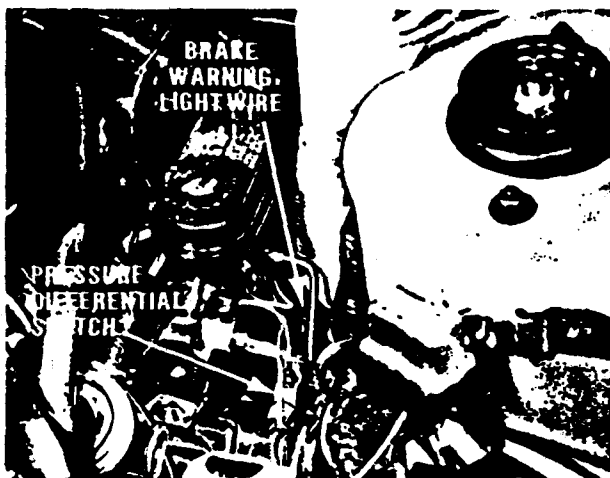


Fig. 4 — Locating and inspecting the warning light wire.

FLUID LEVEL CHECK

After testing the warning light circuit, you should check the brake fluid level in the reservoir on top of the master cylinder. Wipe away any contaminants from the top of the reservoir, remove both covers, and then inspect the fluid level in both chambers. If the fluid level is unusually low, it may indicate an external leak in the brake system.

Next, look at the underside of each reservoir cap to make sure the cap diaphragm is not swollen (Fig. 5).



Fig. 5 — Swollen diaphragms mean brake fluid contamination.

If the diaphragms are swollen, it means that the brake system is contaminated with a petroleum-based fluid.

If either of these problem conditions exists — unusually low fluid level or swollen cap diaphragms — then you'll have to repair the brake system according to the procedures in your Service Manual.

PEDAL GOES TO FLOOR?

When you receive a customer complaint that the brake pedal "feels" like it goes to the floor, it may be caused by a lack of adequate engine vacuum, a booster vacuum leak, normal booster runout, or a hydraulic system problem. To determine which condition exists, you will have to perform the Basic Hydraulic Test, then the Booster Functional Test.

BASIC HYDRAULIC TEST

Start the engine to perform the Basic Hydraulic Test. Then *slowly apply* the brake pedal and *gradually increase* the pedal effort while looking at the brake warning light.

If the warning light turns on during moderate pedal effort and *stays on* when the pedal is released and there is no indication of a fluid leak, then the master cylinder has an internal leak, so replace it.

If the light comes on at moderate-to-heavy pedal effort *but goes out* when the pedal is released, there is air in the brake system, causing a spongy pedal. To correct this condition, bleed the brake system.

If the warning light turns on *after holding* heavy pedal effort for several seconds and *stays on* when the pedal is released, look for an external leak in the system.

Remember, all front-wheel-drive vehicles have a latching-type brake warning pressure differential switch. If you have air trapped in either side of the brake system, the latching-type warning switch will turn the light on when you apply the brakes, and the light will go off when you take your foot off the brake pedal. But if you have a defective master cylinder or hydraulic leakage in the system, then the latching-type warning switch will come on and stay on. If you can't get the warning light to come on and stay on, you do not have a defective master cylinder or an external leak.

BOOSTER FUNCTIONAL TEST

With the engine off, pump the brake pedal at least three times to exhaust any vacuum reserve from the booster. Then hold the pedal with approximately twenty-five pounds of effort.

After starting the engine, the pedal should fall slightly to show that the booster is working properly (Fig. 6).



Fig. 6 — The pedal should fall approximately one and a half inches.

If the vacuum booster does *not* operate properly in the Functional Test, you'll first have to check the vacuum supply hose to make sure it's not pinched, kinked, or leaking (Fig. 7).

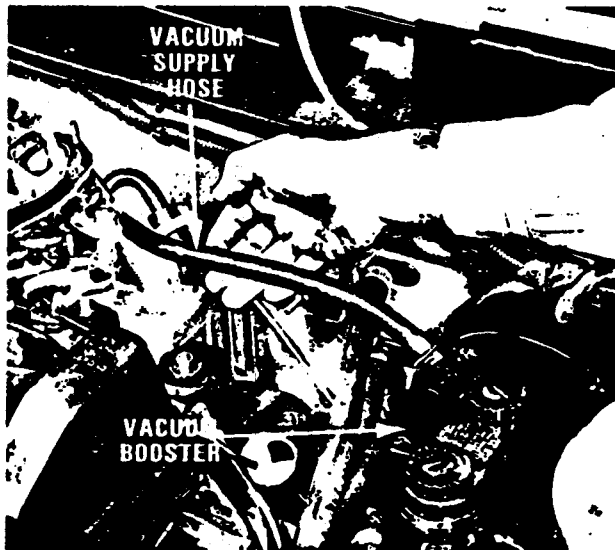


Fig. 7 — A leaking hose will affect the function of power brake system.

Next, test the vacuum supply level at the booster check valve by connecting a vacuum gauge to the speed control port (Fig. 8).

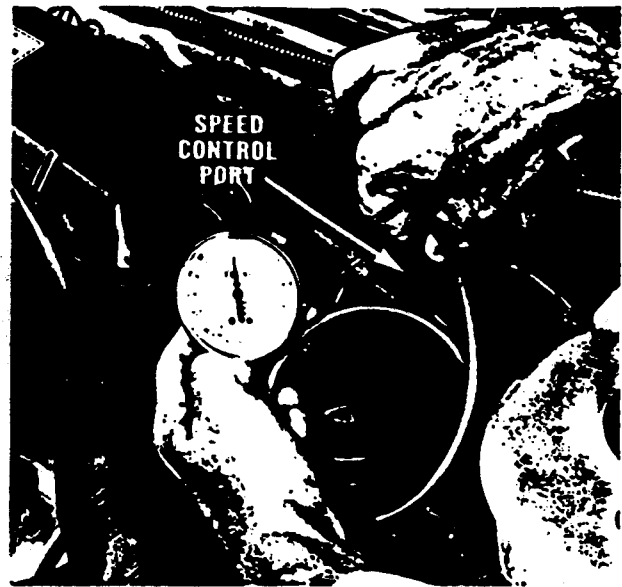


Fig. 8 — Connecting the vacuum gauge to the speed control port.

With the engine running at curb idle, the gauge should read normal engine vacuum. Low vacuum results in poor power brake performance. If engine vacuum levels are lower than normal, then you should check engine timing, the curb idle speed and fast idle speed settings, and the A/C Idle-up speed setting to ensure that they are within specifications. If they are not, correct as required.

If the vacuum supply is adequate but the pedal didn't fall during the Functional Test, the booster is defective and should be replaced.

However, if the booster operation and the vacuum supply level are okay, further diagnosis is still required — Unapplied Vacuum Leak Test and Applied Vacuum Leak Test.

UNAPPLIED VACUUM LEAK TEST

To perform the Unapplied Vacuum Leak Test, start the engine to build booster vacuum. After building up the booster's vacuum, turn off the engine and wait 90 seconds, then press the brake pedal to see if the booster still has vacuum assistance. It should.

APPLIED VACUUM LEAK TEST

Perform the Applied Vacuum Leak Test by running the engine at curb idle while moderately holding down the brake pedal. If the engine begins to run roughly or if there's a continuous hissing sound coming from the booster, then the vacuum booster is defective, and it will have to be replaced.

3 Disc Brake Service

Several changes have occurred in the front-wheel-drive disc brake system for 1983.

DISC BRAKE COMPONENTS

For instance, some vehicles use the new Kelsey Hayes single-pin caliper while other vehicles continue to use the A.T.E. dual-pin caliper (Fig. 9).

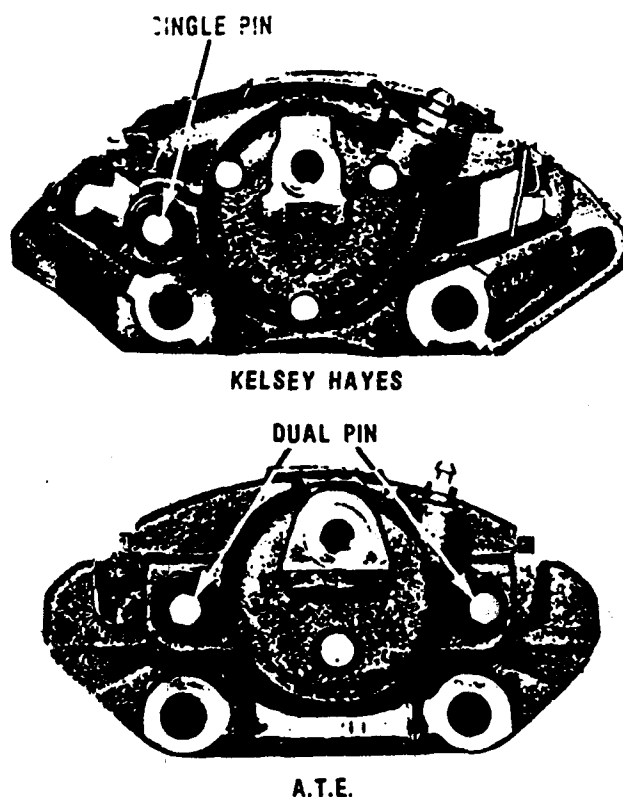


Fig. 9 — The single-pin caliper is new for this year.

All calipers use a 54-millimeter phenolic piston. Combined with its "pressed-in" dust boot, the phenolic piston provides superior corrosion protection and heat insulation.

The lightweight Kelsey Hayes and A.T.E. pistons look almost identical. The pistons have a common diameter; however, the Kelsey Hayes piston is three millimeters longer (Fig. 10). *Do not interchange them.*

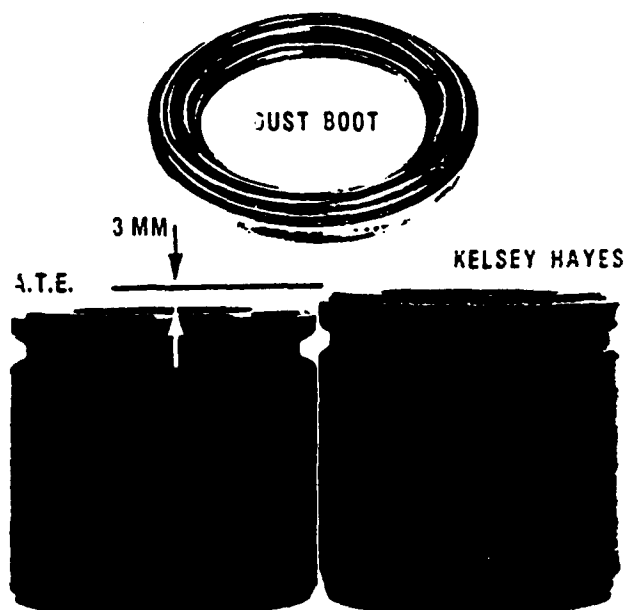


Fig. 10 — All front-wheel-drive calipers use a 54-millimeter piston.

Also new on all riveted front linings is the improved gasket with a double-sided contact adhesive used for additional noise suppression (Fig. 11).

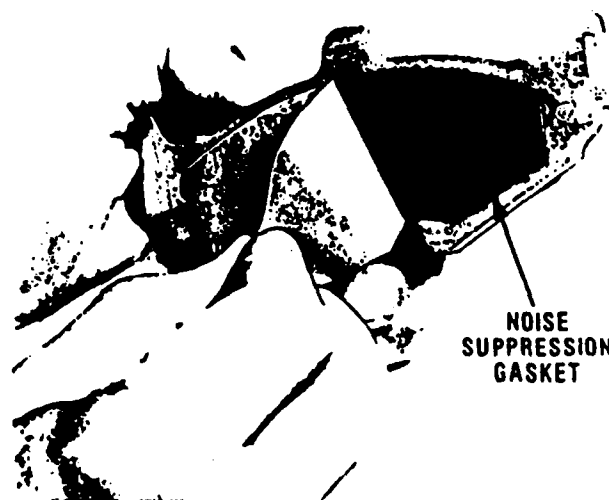


Fig. 11 — This adhesive gasket decreases brake noise.

CAUTION

By the way, *do not* interchange brake components or parts, so make sure that you use the correct part numbers. And while we are on this point, 1983 brake components are not to be used to update previous brake systems.

SERVICING THE LINING ASSEMBLIES

Before you begin to service the disc brakes, it's always a good idea to check the brake line tubing for cracks, dents, or worn spots. Any abrasions, cuts, or cracks in the rubber brake hose indicate that the hose should immediately be replaced (Fig. 12).



Fig. 12 — Give the brake lines and hoses a thorough inspection.

If hose deterioration does occur, it will more than likely happen in the area near the brake hose intermediate bracket or at the hose end fittings.



Fig. 13 — Make sure the wrench is seated firmly on the pin head.

To service the disc brake lining assemblies on the single-pin caliper, you will first have to remove the caliper pin with a 10-millimeter socket (Fig. 13).

After removing the pin, wedge the caliper away from the rotor with a screwdriver to break the gasket adhesive seals (Fig. 14).

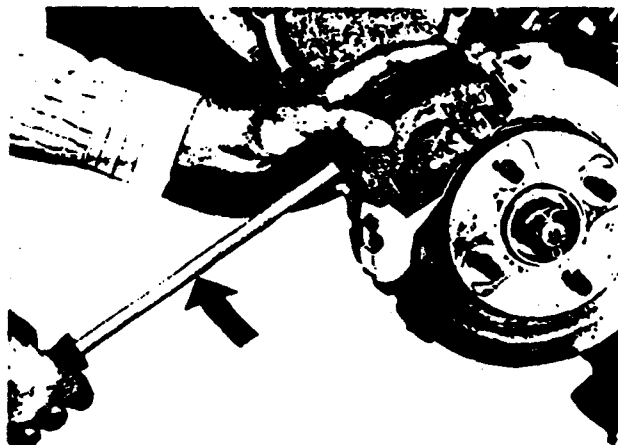


Fig. 14 — Use the rotor as the pivot point for the screwdriver.

Then hang the caliper from the suspension to prevent damage to the brake hose (Fig. 15).

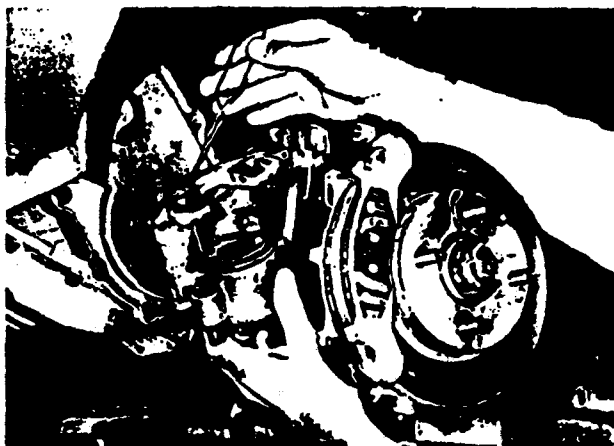


Fig. 15 — An ordinary coat hanger makes an excellent support.

Next, remove the outboard disc brake lining assembly, the rotor, and the inboard lining.

When any brake shoe and lining assembly is worn below $\frac{5}{16}$ inch, all of the front brake pads must be replaced. The measurement should be made across the thinnest portion of the brake pad and shoe assembly, excluding the gasket (Fig. 16).

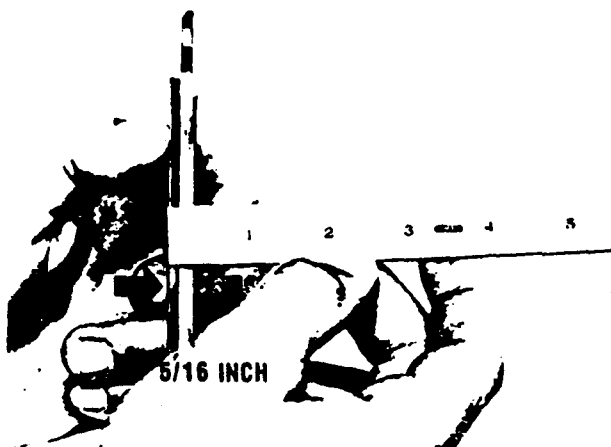


Fig. 16— Discard all brake pads, even if only one is worn below $\frac{5}{16}$ inch.

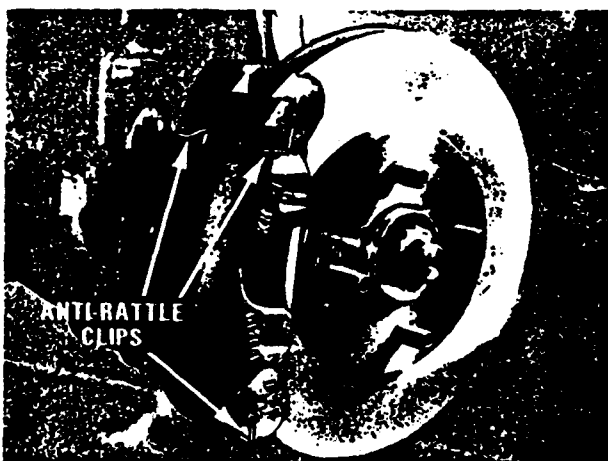


Fig. 17— Mopar disc brake pads have the anti-rattle clips already installed.

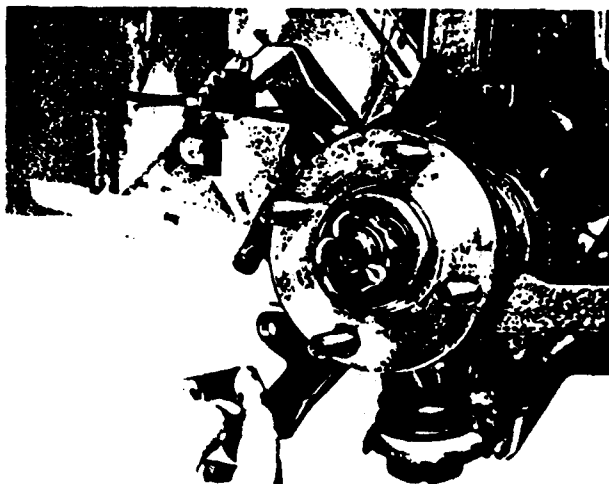


Fig. 18— Apply the lubricant to only the four adapter way surfaces.

Remember to use only the type of replacement pads that are designed specifically for the kind of caliper being serviced. It's also very important that each anti-rattle clip be properly installed on each pad and caliper. (Fig. 17).

Before you install the new disc brake shoe and lining assemblies, liberally apply Mopar Multipurpose Lubricant to both adapter ways (Fig. 18).

Insert the inboard brake pad on the adapter, but be careful not to get any grease from the adapter ways on the lining surfaces. Next, install the rotor on the hub, then slide the outboard pad on the adapter, and remove the protective paper from both noise suppression gaskets.

SERVICING THE CALIPER

Before you service the caliper, inspect it for any evidence of cuts or brake fluid leaks at the piston's dust boot (Fig. 19).

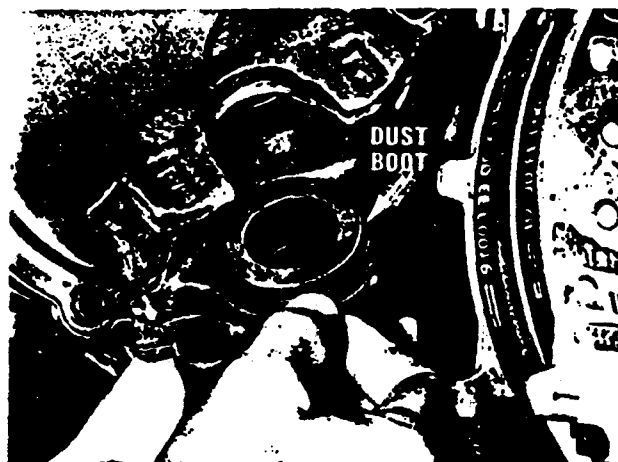


Fig. 19— Any sign of leakage indicates caliper service.

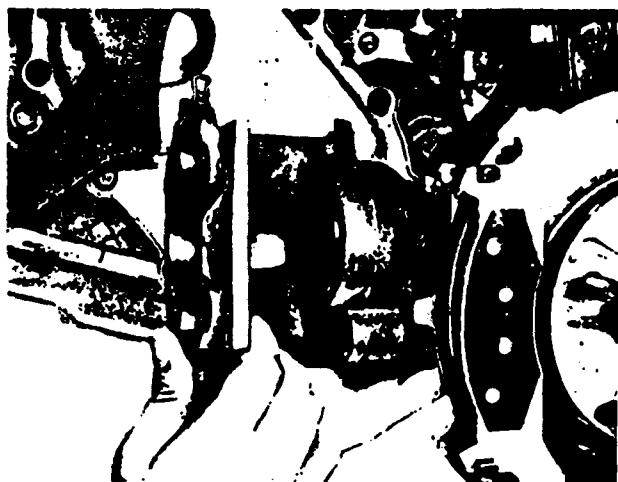


Fig. 20— Protect the phenolic piston with a block of wood.

To service the caliper, place a small piece of wood between the piston and caliper fingers, then have your assistant slowly depress the brake pedal several times to ease the piston out of its bore (Fig. 20).

Be sure to keep your fingers clear of the moving piston.

Be sure to depress and hold the brake pedal down a minimum of one inch to prevent excessive brake fluid loss at the caliper (Fig. 21).



Fig. 21 — Depress and hold the brake pedal down a minimum of one inch.

Next, remove the "banjo" bolt securing the brake hose to the caliper (Fig. 22), then carefully mount the caliper in a vise with brass protected jaws.

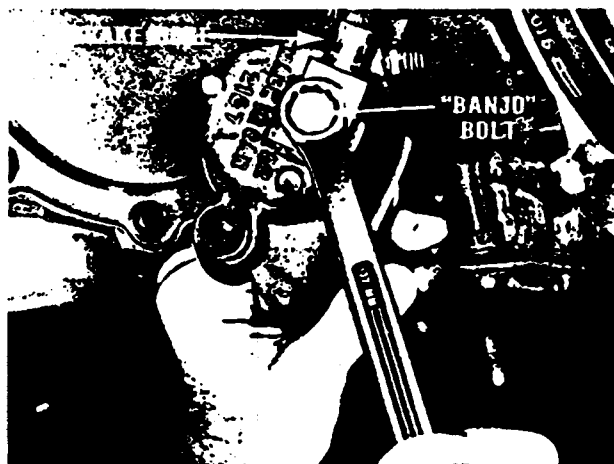


Fig. 22 — Removing the "banjo" bolt.

While removing the piston's dust boot with a thin blade screwdriver, make sure that you do not scratch or chip the surface of the dust boot counterbore (Fig. 23).

Use the same kind of care when you remove the old piston seal from the caliper bore (Fig. 24).

Always avoid nicking the bore's surface.



Fig. 23 — Removing the dust boot.

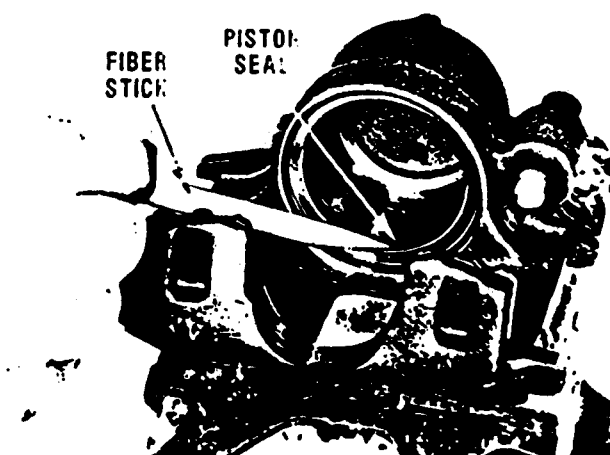


Fig. 24 — Use a fiber stick to ensure a clean removal.

If a close inspection reveals light scratches or corrosion in the caliper bore, it can usually be cleaned with a crocus cloth (Fig. 25).

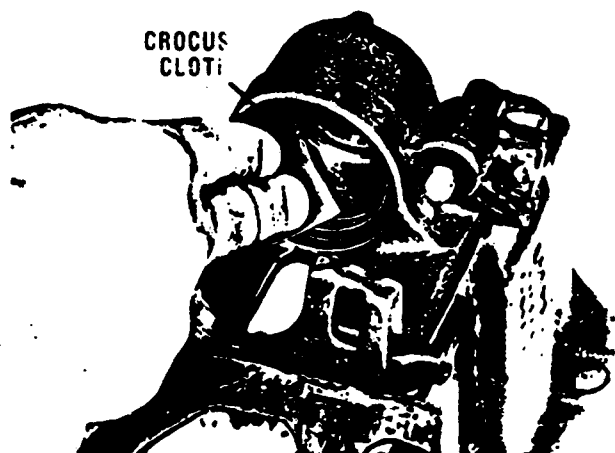


Fig. 25 — Clean the caliper bore with brake fluid after using the crocus cloth.

After cleaning the bore, flush it with clean brake fluid to remove any abrasive material that may be left by the crocus cloth.

When assembling the caliper, lubricate a new piston seal in clean brake fluid, then gently work seal around with your finger until it is squarely seated (Fig. 26).

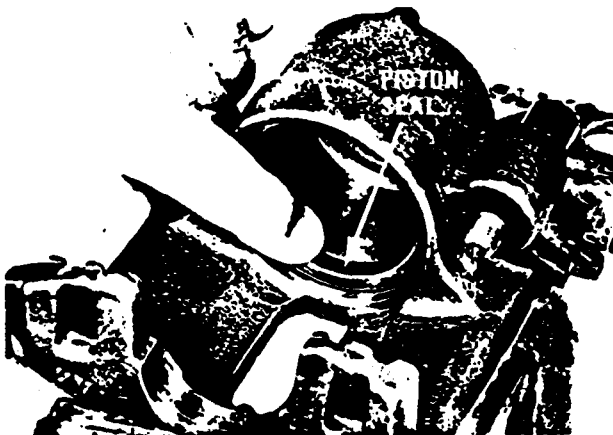


Fig. 26 — Be sure the piston seal is completely seated.

Coat the new dust boot with brake fluid and slide it over the piston to properly position it in the piston groove (Fig. 27).

After installing the dust boot, lubricate the outside of the piston with brake fluid and push the piston past its seal to bottom the piston against the base of the caliper bore (Fig. 28).

Then properly seat the lip of the dust boot into the counterbore surrounding the piston.



Fig. 27 — Make sure the dust boot is properly seated in the piston groove.

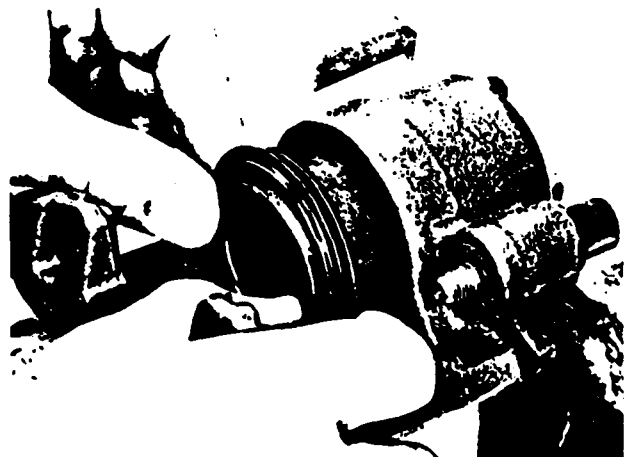


Fig. 28 — A steady, straight motion will clear the piston past its seal.

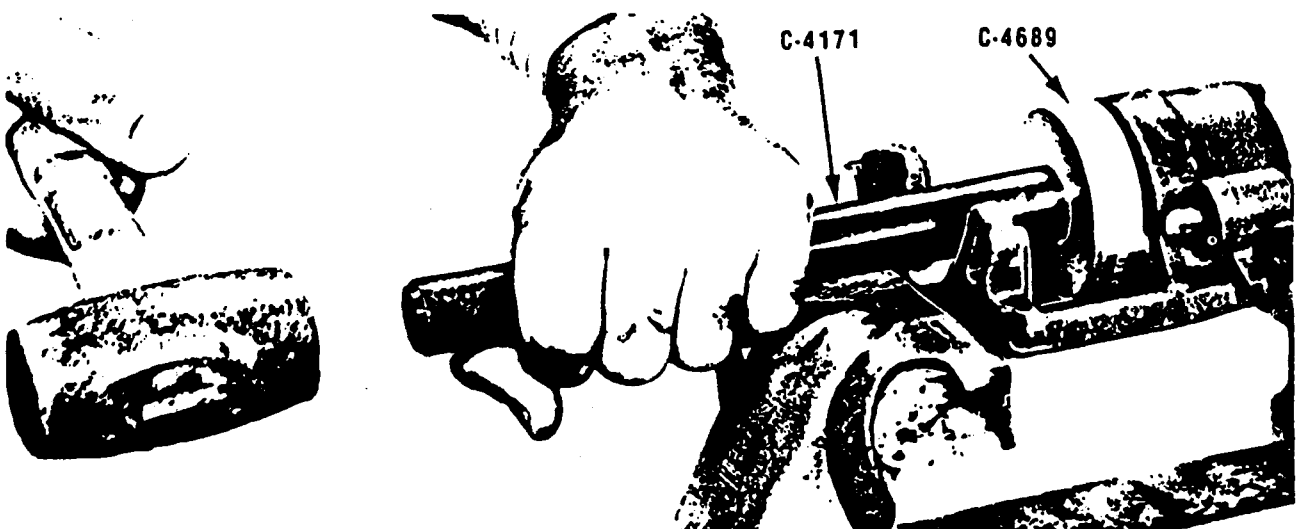


Fig. 29 — Check the dust boot seal to make sure it's straight before driving it.

To complete the caliper assembly procedure, drive the dust boot into the counterbore as shown in Fig. 29.

After cleaning the caliper fingers and piston face with a clean cloth so the noise suppression gaskets will stick, carefully position the caliper over its adapter so that it straddles the rotor and both brake pads.

Next, carefully thread the caliper pin into the adapter. Make sure that it doesn't cross-thread. Then torque the caliper pin between 25 to 35 foot-pounds while holding the socket squarely on the pin head (Fig. 30).

After reconnecting the brake hose with new copper gasket(s) on the "banjo" bolt, bleed the brake system according to the procedures outlined in your Service Manual.



Fig. 30 — Hold the socket squarely on the pin head.

4 Drum Brake Service

The first step in servicing the self-adjusting rear brakes is to "slack off" the parking brake cable to allow easier removal of the drum. This is done by unthreading the parking brake cable adjustment nut (Fig. 31).



Fig. 31 — Loosening the parking brake cable.

Further clearance can be obtained at the rear brake assembly by rotating the starwheel to back off the self-adjuster with an upward motion on the scwdriver or special tool (Fig. 32).

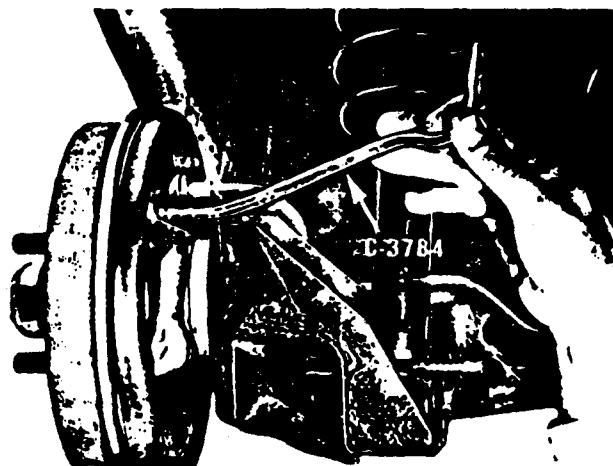


Fig. 32 — Backing off the self-adjuster's starwheel.

DRUM BRAKE DISASSEMBLY

After removing the brake drums, inspect the leading and trailing brake shoes to make sure that they have not been worn excessively. If the brake shoes are worn to the lining rivets, then more than likely the brake drum will require service.

LINING ASSEMBLY REPLACEMENT

To replace the rear brake lining assemblies, remove the self-adjusting lever and its spring (Fig. 33).

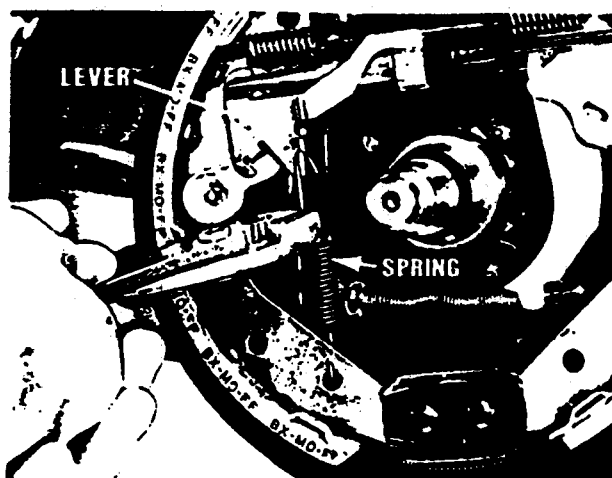


Fig. 33 — Removing the self-adjusting lever spring.

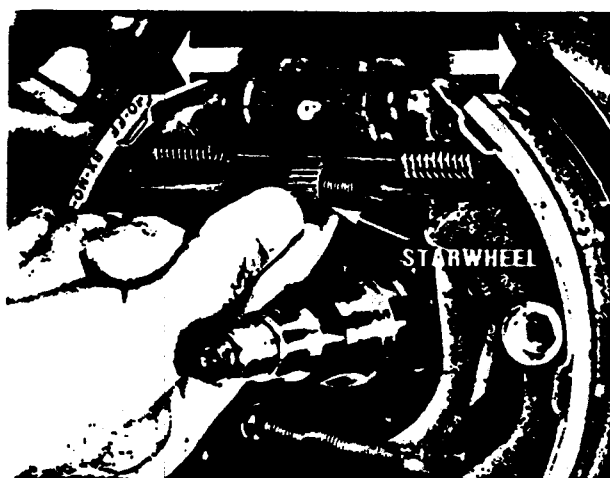


Fig. 34 — Expanding the brake shoes to clear the wheel cylinder boots.

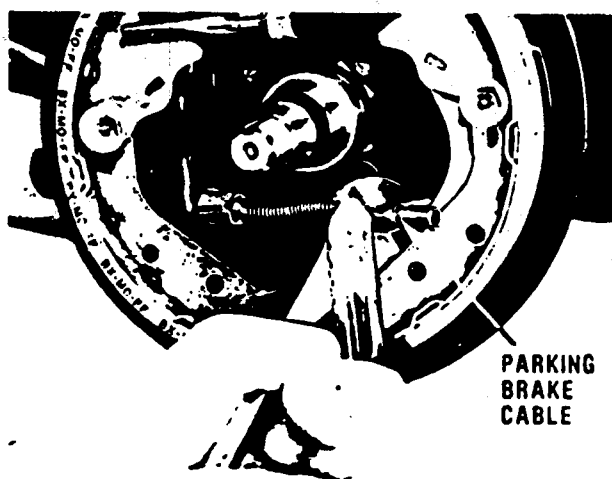


Fig. 35 — Pull the cable spring forward, then lift it from the lever.

Then rotate the self-adjusting starwheel so that each shoe expands far enough to be free from the wheel cylinder boots (Fig. 34).

Disconnect the parking brake cable from the parking brake lever (Fig. 35).

Next, use a special tool to release the two hold-down springs securing the lining assemblies to the brake support plate (Fig. 36).

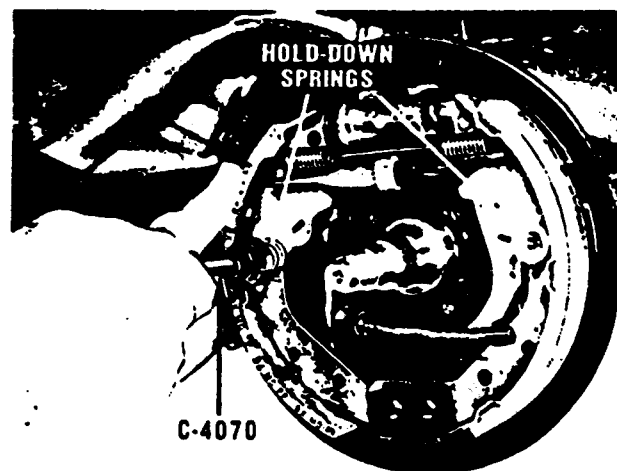


Fig. 36 — Removing the two hold-down springs.

Now remove both brake shoes and lining assemblies from the brake support plate.

PARKING BRAKE LEVER REMOVAL

To replace the trailing shoe, disengage the retainer clip securing the parking brake lever to the old trailing shoe (Fig. 37).

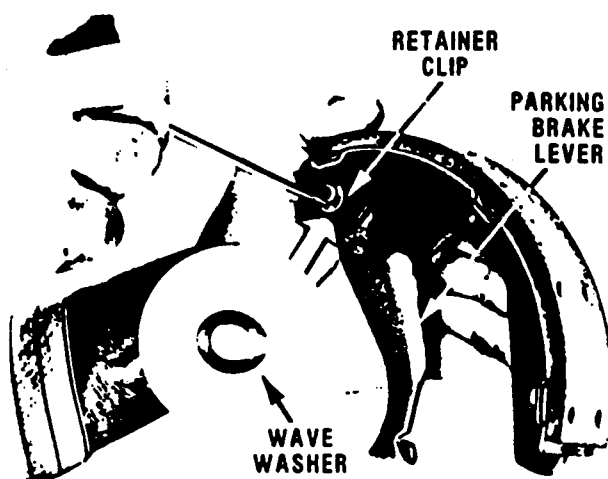


Fig. 37 — Be sure not to lose the parking brake lever wave washer.

Then connect the old parking brake lever and its wave washer on the new replacement shoe.

Next, attach the upper return spring between the two new lining assemblies (Fig. 38).

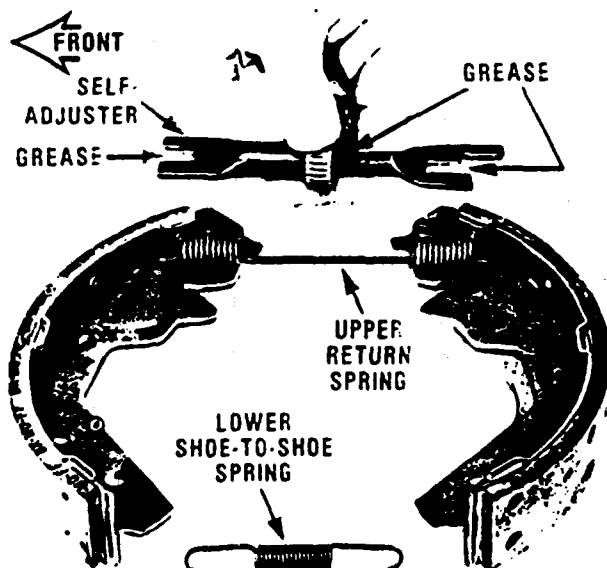


Fig. 38 — Be sure the self-adjuster is properly installed.

Apply grease to the self-adjuster as shown in (Fig. 38). With the stepped forks of the self-adjuster facing toward the outboard side of the shoes and with the longer fork pointing rearward, install the self-adjuster between the two lining assemblies. Then connect the lower shoe-to-shoe spring at the bottom of the two lining assemblies.

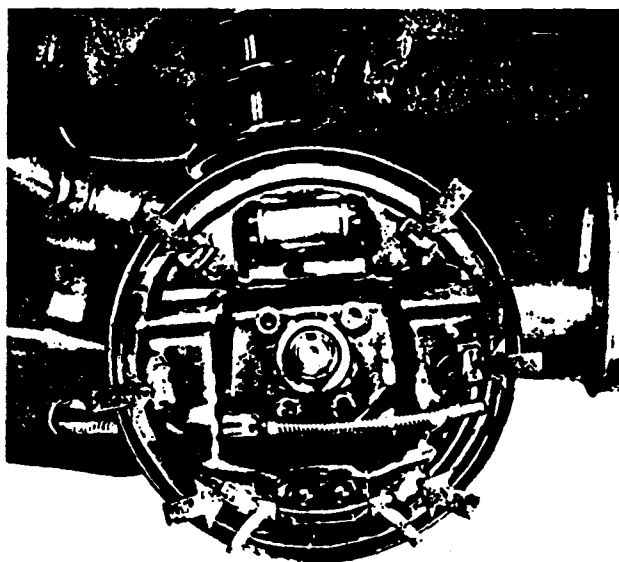


Fig. 39 — Use a moderate amount of lubricant.

DRUM BRAKE ASSEMBLY

Before you install the new lining assemblies to the brake support plate, be sure to grease the eight shoe contact areas on the support plate and anchor with Mopar Multipurpose Lubricant (Fig. 39).

After expanding the self-adjuster so the top end of shoes clear the wheel cylinder boots, install the brake shoe and lining assemblies.

Next, install the two hold-down springs to secure the lining assemblies to the brake support plate (Fig. 36). Then assemble the self-adjusting lever and attach its spring (Fig. 33).

After connecting the parking brake cable, pre-adjust the rear brake shoes so that they don't interfere with the installation of the drum. *Be sure the starwheel contacts the self-adjuster's tubular strut.*

After properly adjusting the wheel bearings according to the procedures outlined in your Service Manual, pump the brake pedal several times to partially complete the shoe adjustment (Fig. 40).



Fig. 40 — Pump the pedal ten to fifteen times to partially complete the brake adjustment.

These new brakes adjust every time you stroke the pedal. After adjusting the parking brake cable, perform a road test. The self-adjusters will continue the brake adjustment during the test.

5 Brake Bleeding Update

When bleeding the brake system, some air may be trapped in the brake line or valving far upstream, sometimes as much as ten feet from the bleeder screw (Fig. 41). Therefore, it is absolutely essential to have a fast flow of a large volume of brake fluid when bleeding the brakes to ensure getting all the air out.

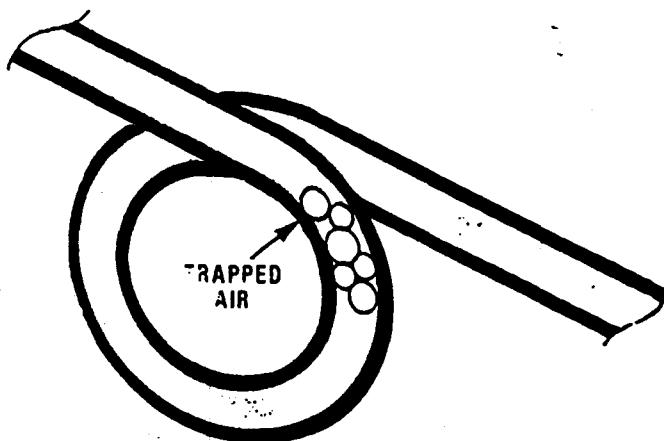


Fig. 41 — Trapped air in brake line far upstream from brake.

PROCEDURE UPDATE

To bleed the brake system, attach a clear plastic hose to the bleeder screw at one wheel and feed the hose into a clear jar containing fresh brake fluid (Fig. 42).

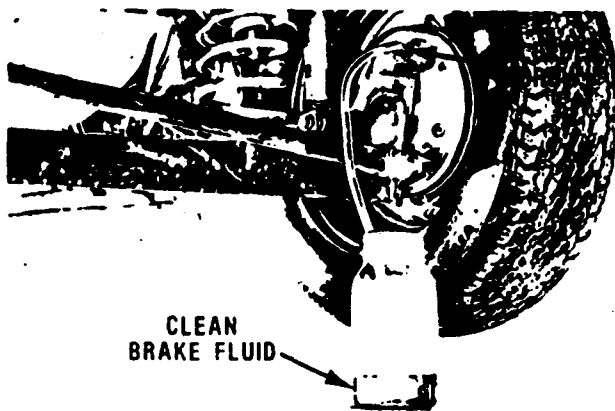


Fig. 42 — Attach a clear plastic hose to the bleeder screw and feed the hose into a clear jar of clean brake fluid.

Next, open the bleeder screw at least *one full turn* or better (Fig. 43).

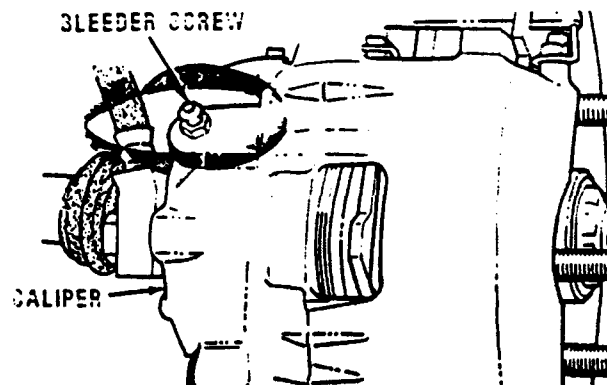


Fig. 43 — Open the bleeder screw at least one full turn.

IMPORTANT

Just "cracking" the bleeder screw often restricts fluid flow, and a slow, weak fluid discharge will *not* get all the air out.

After a good volume of fluid has been forced through the brake system, an "air-free flow" in the clear plastic hose and jar will indicate a good bleed.

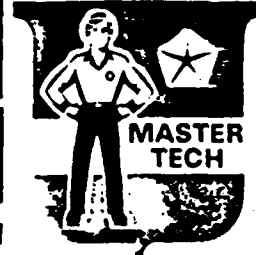
Repeat the procedure at all the other remaining bleeder screws, then check the pedal for pedal travel. If pedal travel is excessive or has not been improved, not enough fluid has passed through the system to expel all the trapped air.

BLEEDING WITHOUT A PRESSURE BLEEDER

If a pressure bleeder is not available, a good fluid flow can be obtained by following these steps:

1. Pump the pedal three or four times and hold it down before the bleeder screw is opened.
2. Push the pedal to the floor and hold it down while the bleeder screw is opened.
3. Release the pedal rapidly *after* the bleeder screw is closed.
4. Repeat steps 1 through 3, four or five times, at each bleeder screw to pass a sufficient amount of fluid to expel all the trapped air from anywhere in the brake system.

MASTER TECH



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**1989
BRAKE SYSTEMS UPDATE**

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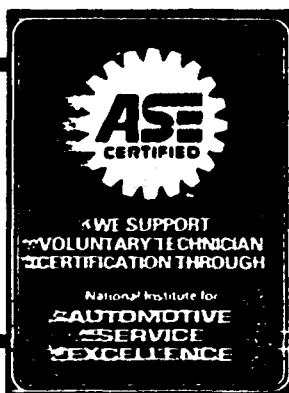




THE NEW REAR WHEEL ANTI-LOCK SYSTEM

The biggest braking story for 1989 is the all-new Chrysler Rear Wheel Anti-Lock (RWAL) System found on all "D" and "N" body trucks. The RWAL System is designed to prevent rear wheel lockup, keeping the vehicle under control during heavy braking. However, it is important to note that the RWAL System is quite different from that of four-wheel anti-lock systems.

In this month's Reference Book, we will take a look at the new RWAL System, covering its components, operation, and diagnostics. In addition, we will review a few other service highlights, including diagnosis of brake pulsing and service of the proportioning valve.



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RWAL Components and Operation.....	1
RWAL Diagnosis and Service	5
Front/Rear Brake Proportioning Valve	6
Brake Pulsing and Vibration Diagnosis	8

MAJOR COMPONENTS

The Rear Wheel Anti-Lock System features three major components: a speed sensor, an electronic brake control module, and a dual solenoid hydraulic valve.

Speed Sensor

The speed sensor is a single-pole variable-reluctance pickup, mounted at the top of the rear differential housing (Fig. 1). The sensor monitors an exciter ring, which

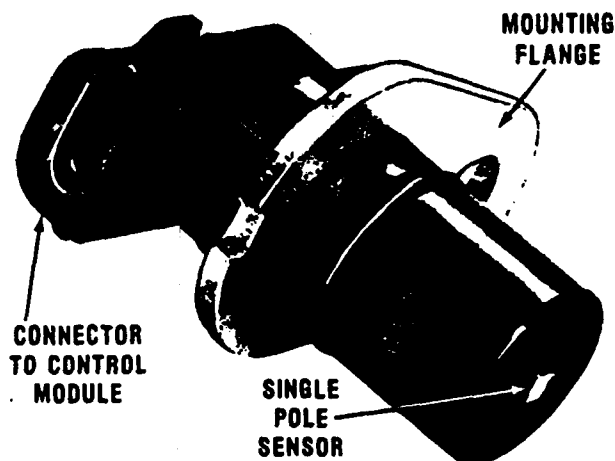


Fig. 1 — Speed sensor.

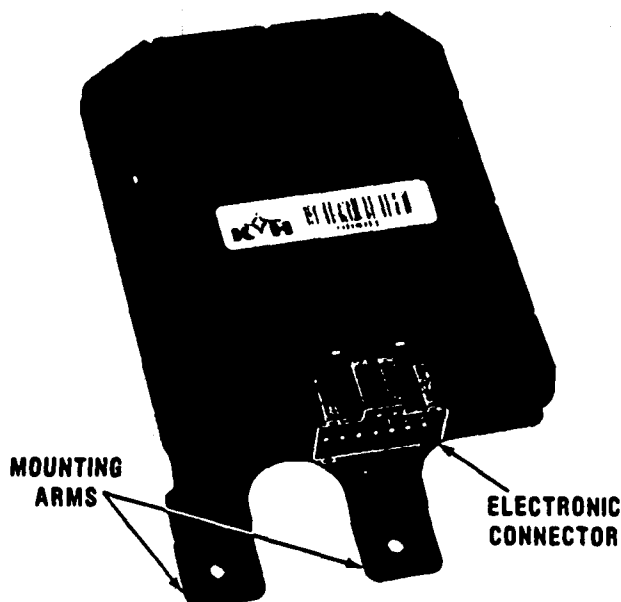


Fig. 2 — Electronic brake control module.

is press fit onto the differential drive gear. This generates the signal used to determine possible rear wheel lockup.

Electronic Brake Control Module

The control module is microprocessor based, and determines lockup tendencies as well as system self-checks (Fig. 2). On "N" body trucks, the module is located in the lower right side cowl. On "D" body trucks, the unit is behind the glove box (Fig. 3).

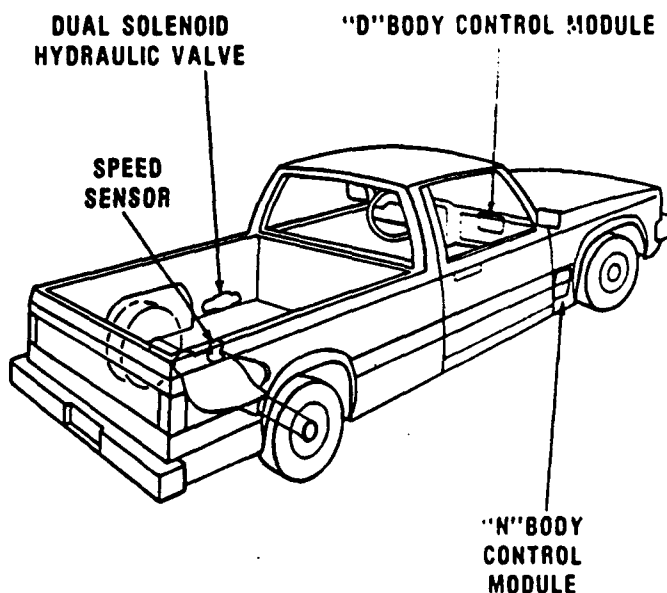


Fig. 3 — RWAL component location.

In addition to its responsibilities during rear wheel lockup, the module performs self-check diagnostics. When the ignition key is turned to the "on" position, the system self-checks:

- the RWAL and brake warning lights by illuminating them for about two seconds.
- all of its electrical circuits for shorts and opens.
- the dual solenoid hydraulic valve's isolation and dump valves by activating them.

Also, in the event that a problem exists in the anti-lock function, the module will shut the system down and the vehicle will return to normal braking.

Dual Solenoid Hydraulic Valve

The dual solenoid valve (Fig. 4) is the workhorse of the RWAL System and is attached to the left frame rail near the rear axle. The valve is the component that actually adjusts the brake fluid pressure, and consists of an isolation valve, a dump valve, and an accumulator.

During normal braking, the isolation valve is open, allowing fluid pressure to flow directly from the master cylinder to the rear wheels (Fig. 5). The dump valve and accumulator are open only in a rear wheel lockup condition.

All "N" body trucks (Fig. 6) use the same type valve, but the "D" body models utilize one of three different sizes of accumulator, based on the truck's gross vehicle weight rating. The three "D" body (Fig. 7) valves are *not* interchangeable.

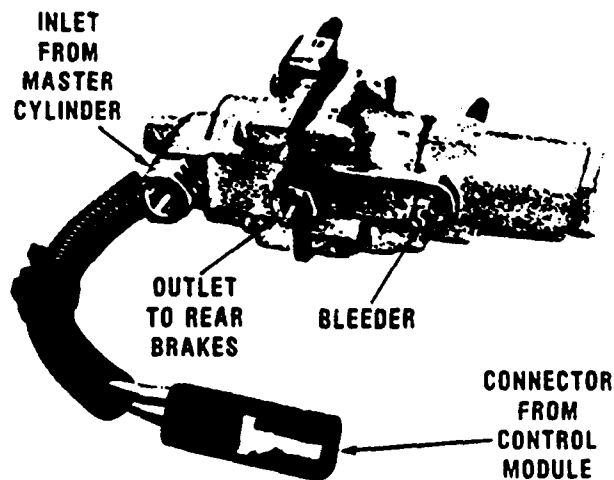


Fig. 4 — Dual solenoid hydraulic valve.

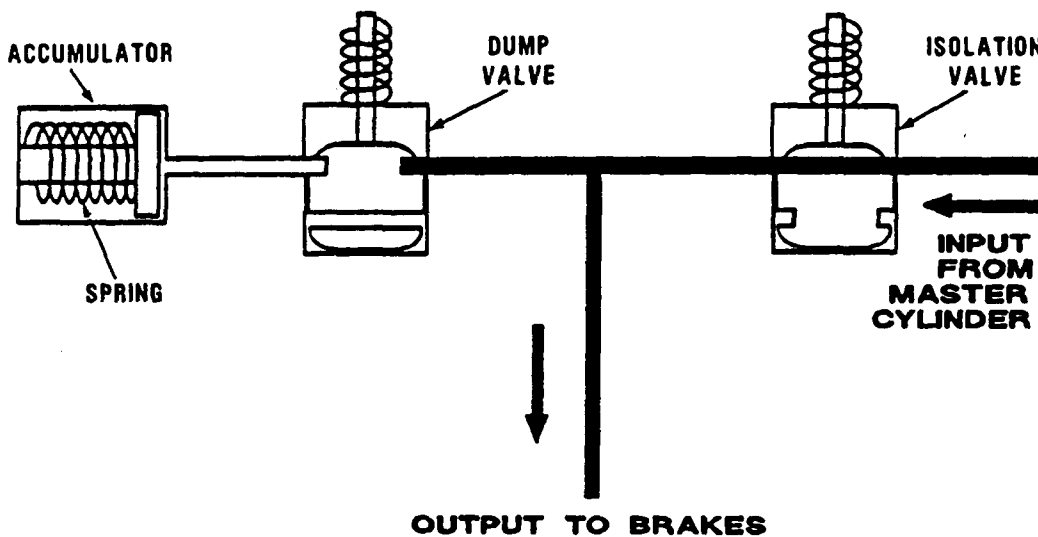


Fig. 5 — Hydraulic valve during normal braking.

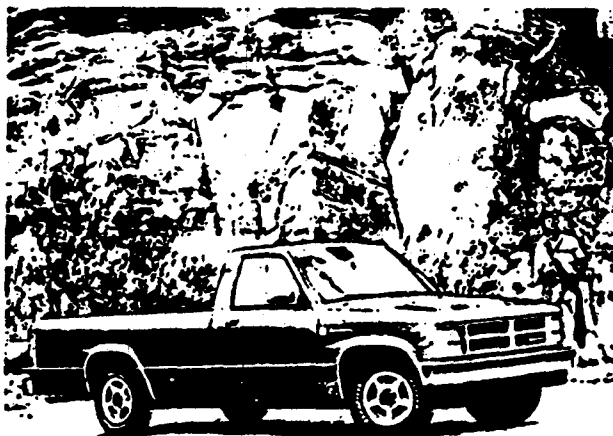


Fig. 6 — "N" body (Dakota).

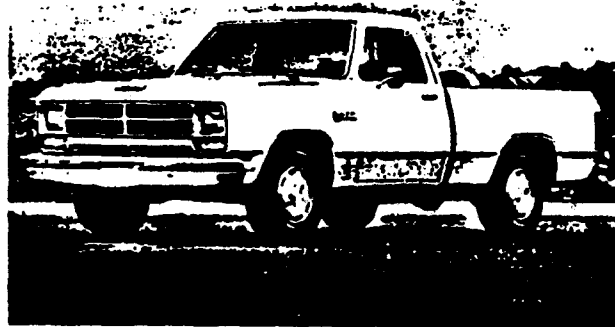


Fig. 7 — "D" body (Power Ram).

SYSTEM OPERATION

When heavy brake pressure is applied, the rear wheels will decelerate at a rate greater than the maximum vehicle deceleration. In other words, the rear wheels show a tendency to lock up. The control module detects this by reading the signal from the speed sensor. The

module then activates the dual solenoid hydraulic valve (Fig. 8).

The hydraulic valve's isolation valve first closes, keeping any additional pressure from the master cylinder away from the rear brakes (Fig. 9).

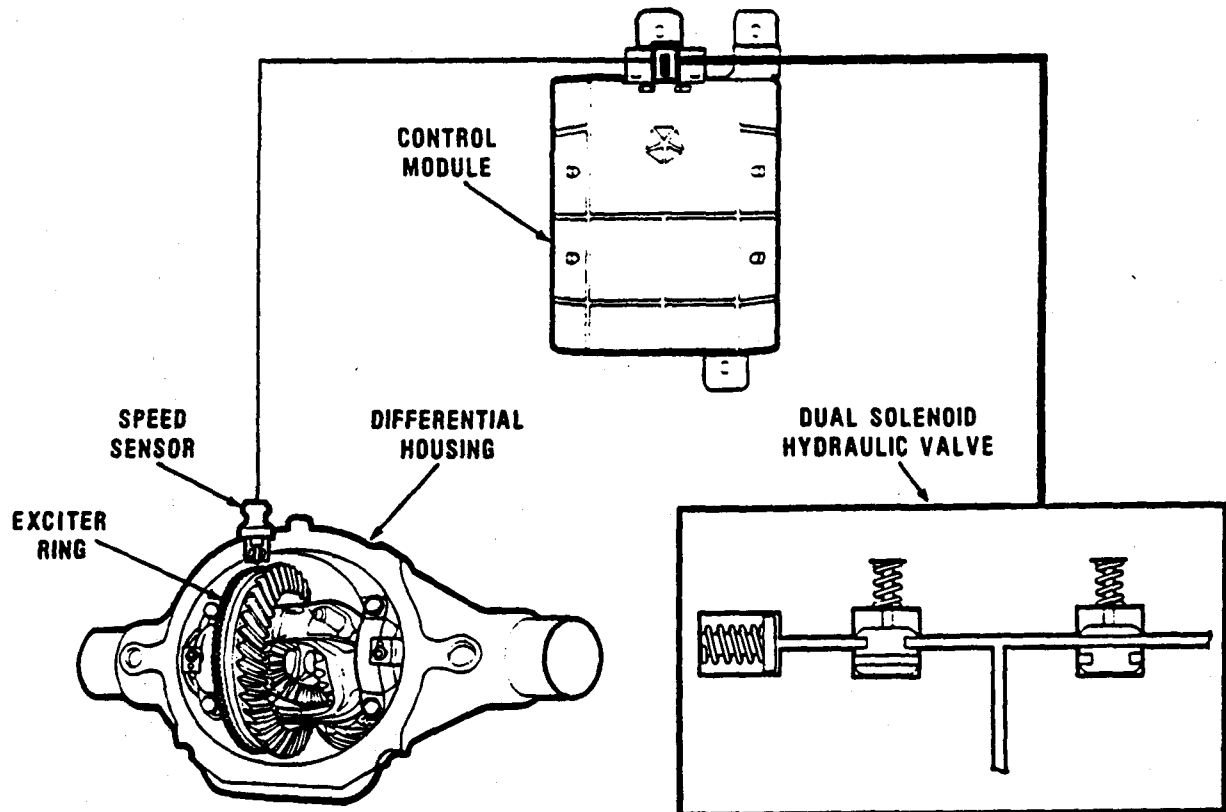


Fig. 8 — RWAL electrical flow.

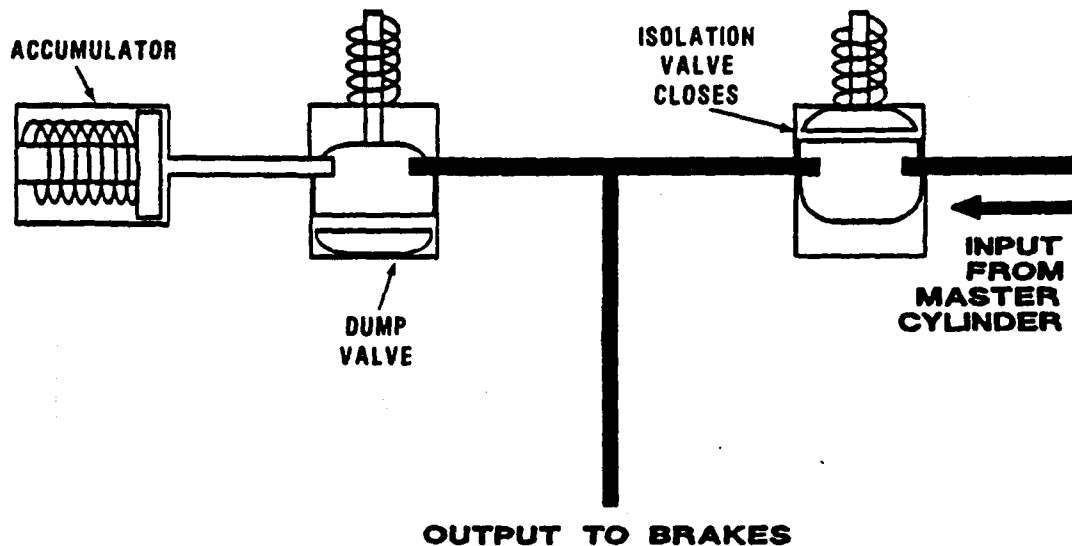


Fig. 9 — Isolation of rear brakes.

If this initial action is not enough to prevent rear wheel lockup, then the control module will activate the dump valve (Fig. 10). The dump valve allows the brake fluid to pass into the accumulator, relieving pressure from the rear brakes. The dump cycle is performed for a very short duration.

The control module will continue to monitor rear wheel deceleration. If the control module determines that the wheels are still showing a tendency to lock, the dump

valve cycle will be repeated (Fig. 11). The dump cycle will continue until the appropriate rear wheel speed is sensed by the control module. A predetermined maximum number of consecutive dump cycles can be performed before the system will shut off.

When the driver releases the brake pedal, the dump cycle counter will reset and any accumulated fluid will be dumped back into the hydraulic circuit.

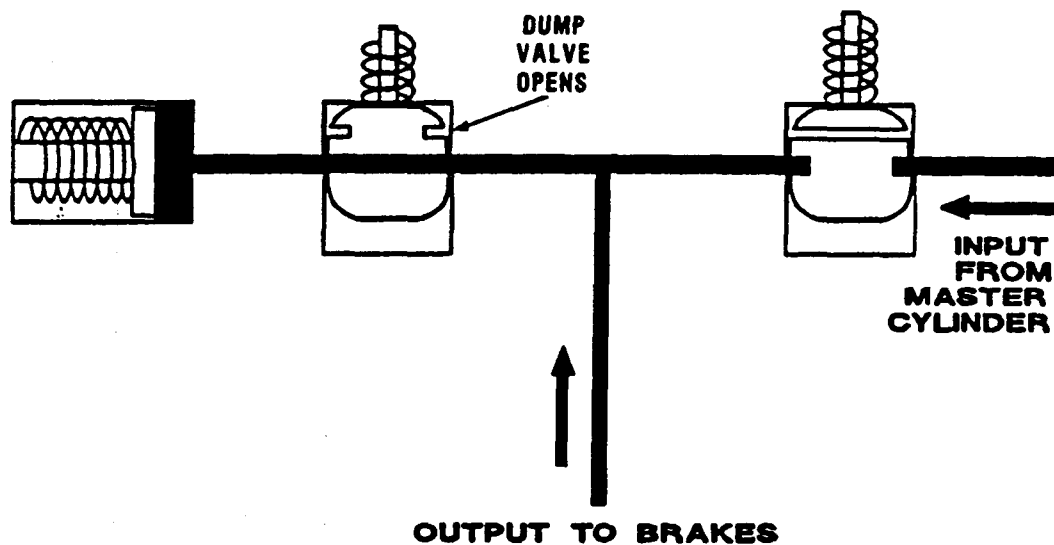


Fig. 10 — Activation of dump valve.

Typical Sequence of Anti-Lock Operation

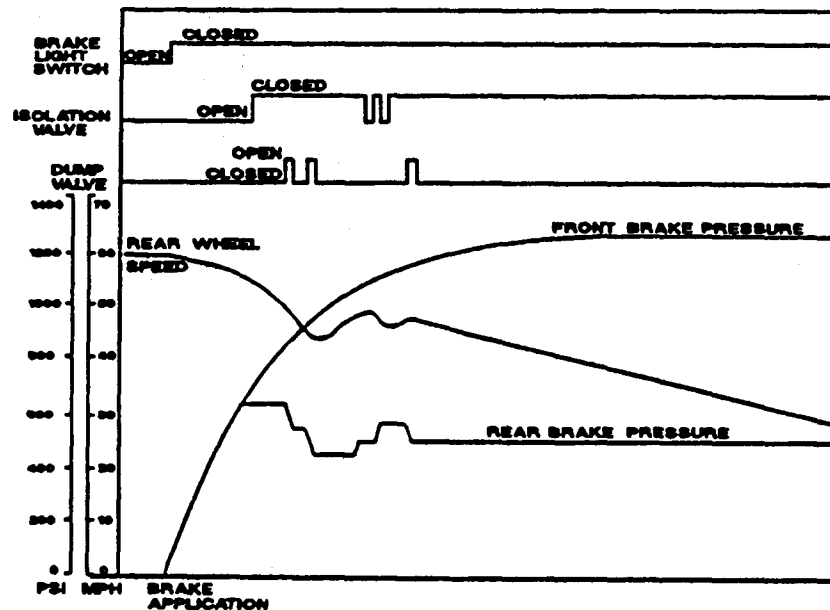


Fig. 11 — System operation graph

2

RWAL DIAGNOSIS AND SERVICE

READING FAULT CODES

When the system's self-check or the system operation identifies a problem, the RWAL System will alert the driver by illuminating the amber anti-lock brake and red brake warning lights (Fig. 12), and will set a fault code. A fault code is stored in the electronic control module and will remain stored even when the vehicle is not in use.

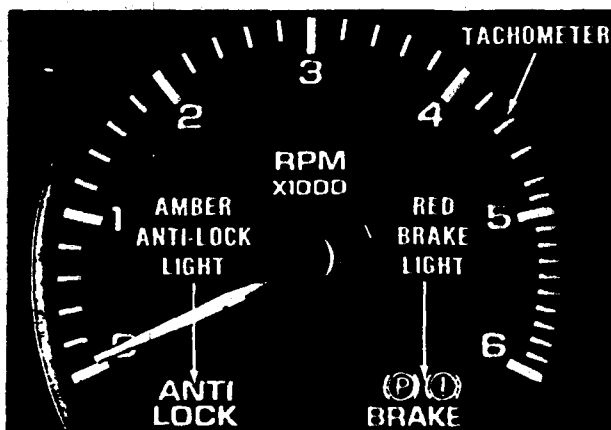


Fig. 12 — Red brake and amber anti-lock warning lights. The figure shown is of an "N" body. The anti-lock and brake warning lights are located in the instrument panel message center on "D" body trucks.

NOTE: Some situations may not reveal a flash-out fault code. Refer to the service manual for diagnosis and service procedures.

To identify the fault code:

1. Ground the RWAL diagnostic connector, located under the glove box on "D" bodies, and in the right-hand instrument panel, against the kick panel on "N" bodies.
2. Count the number of amber anti-lock or red brake warning light flashes. The long initial flash signals the beginning of the code. Count the number of short flashes, then the long flash that signals the start of another series. For example, eight short flashes followed by one long flash indicates a fault code of nine.
NOTE: If the parking brake has been applied, the red brake warning light will not flash.
3. Refer to the code identification chart to determine the system fault (Fig. 13).
4. Follow the prescribed repair procedure in the service manual for the specified system fault.

FAULT CODE NUMBER	TYPICAL FAILURE DETECTED
1	Not used.
2	Open isolation valve wiring or bad control module.
3	Open dump valve wiring or bad control module.
4	Closed RWAL valve switch.
5	Over 16 dump pulses generated in 2WD vehicles (disabled for 4WD).
6	Erratic speed sensor reading while rolling.
7	Electronic control module fuse pellet open, isolation output missing, or valve wiring shorted to ground.
8	Dump output missing or valve wiring shorted to ground.
9	Speed sensor wiring resistance (usually high reading).
10	Sensor wiring/resistance (usually low reading).
11	Brake switch always on. RWAL light comes on when speed exceeds 40 mph.
12	Not used.
13	Electronic control module phase lock loop failure.
14	Electronic control module program check failure.
15	Electronic control module RAM failure

Fig. 13 — Fault code troubleshooting chart.

When a fault has been serviced, you must disconnect the control module from battery power for *five* seconds. The best way to do this is to simply pull the RWAL fuse from the panel. This will avoid having to reprogram any other computer-based system on the vehicle (i.e., the radio's preprogrammed stations).

Then you must turn the key to the "on" position, wait 30 seconds, then drive the vehicle to see if the amber anti-lock and red brake warning lights remain on. Because the control module can only store one fault code at a time, there may be another problem present that was not stored. Test driving the vehicle will alert you to any other problems that would need your attention.

SERVICE PROCEDURES

The servicing of the system is relatively simple. There

are three main points to remember:

1. The speed sensor, hydraulic valve, and electronic control module are serviceable only by replacement as whole component parts. (An important reminder: When replacing the speed sensor, be sure to leave the sensor's seal in place between the sensor and the wiring connector.)
2. There is an additional bleeding step for RWAL vehicles. This requires that the hydraulic valve must be bled before bleeding the rear wheels — using the same procedure as bleeding the individual wheels.
3. All other system service is the same as with non-anti-lock systems.

3

FRONT/REAR BRAKE PROPORTIONING VALVE

The brake proportioning valve is found on all Chrysler vehicles. If premature rear wheel lockup occurs on hard brake applications, this may indicate a malfunction of the proportioning valve. The valve is actually a two-system unit. On rear-wheel-drive trucks, the valve is split in a front/rear fashion. And on most other Chrysler vehi-

cles, one half controls the right rear and left front brakes, while the other half controls the left rear and right front brakes. This is commonly known as a diagonally split unit (Fig. 14). Because of this, it is necessary to road test the vehicle to determine which rear wheel locks first.

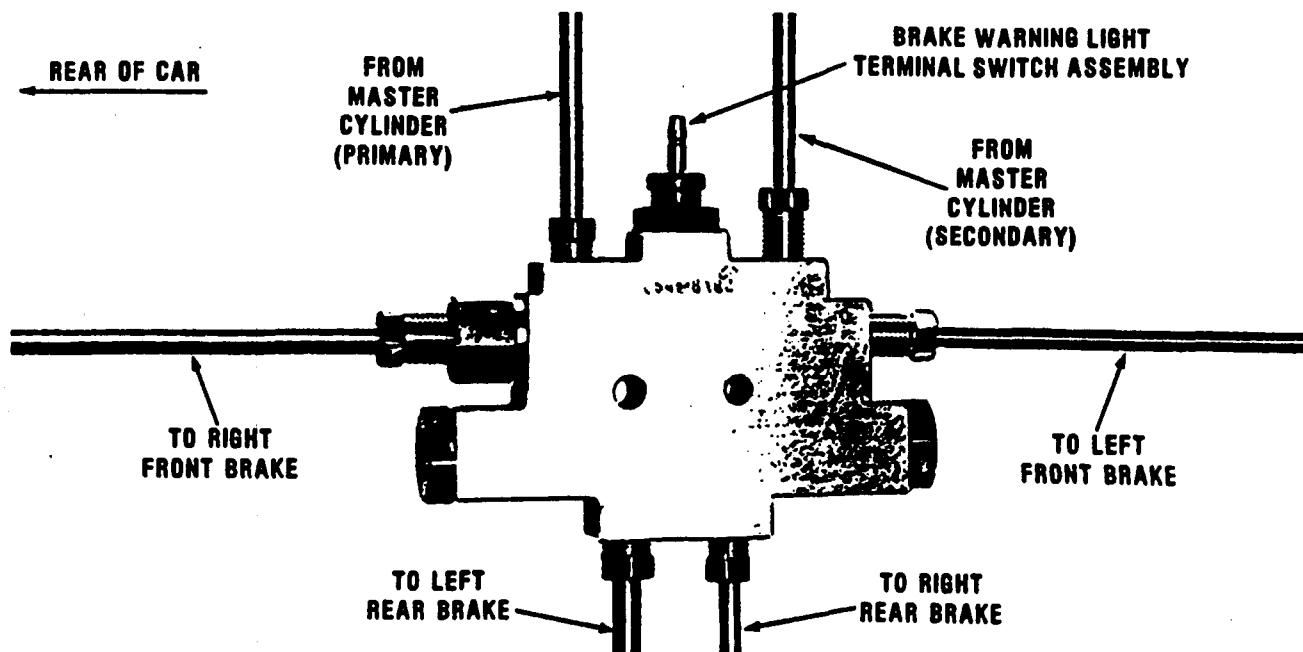


Fig. 14 — Brake proportioning valve.

Service Example — "P" Body

If the road test revealed that the right rear wheel locked first, the proportioning valve test would be as follows:

1. Leave the front brake lines connected to the valve (Fig. 15).

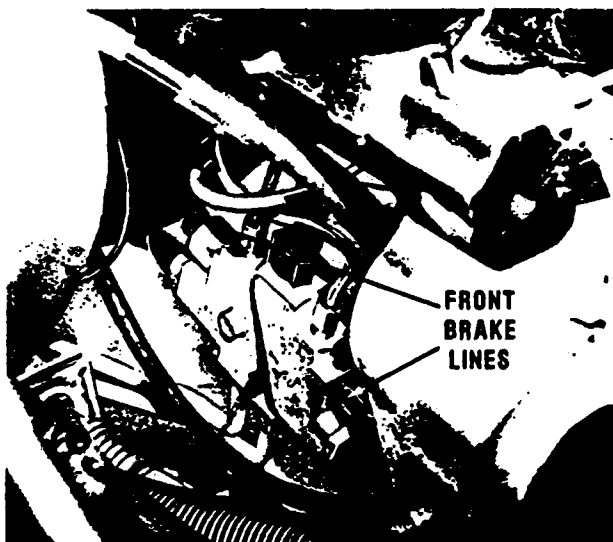


Fig. 15 — Front brake lines.

2. Remove the master cylinder secondary port line, then attach a T-pipe and gauge to the valve (Fig. 16).

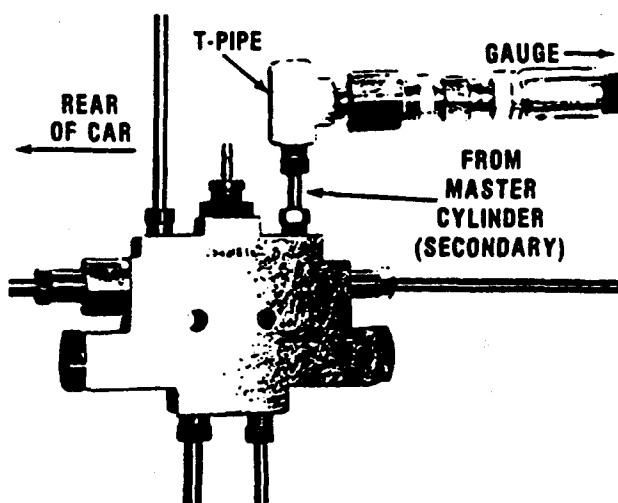


Fig. 16 — Installation of T-pipe and gauge.

3. Reattach the master cylinder secondary port line to the T-pipe (Fig. 17).
4. Remove the right rear outlet hose from the valve, then install a second gauge to this port using spare brake tubing and 3/8th-inch tube nuts (Fig. 18).

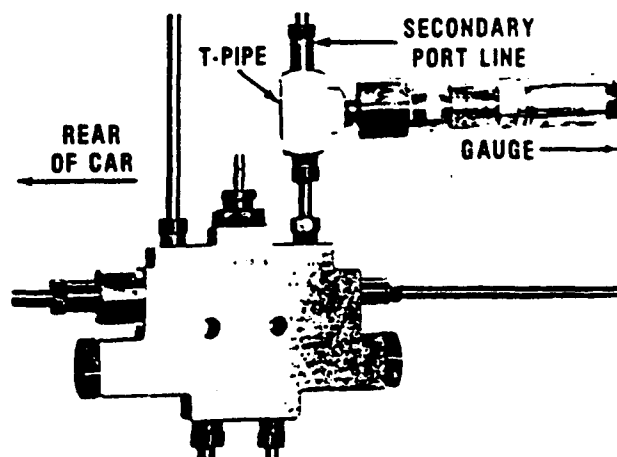


Fig. 17 — Secondary port line reattachment

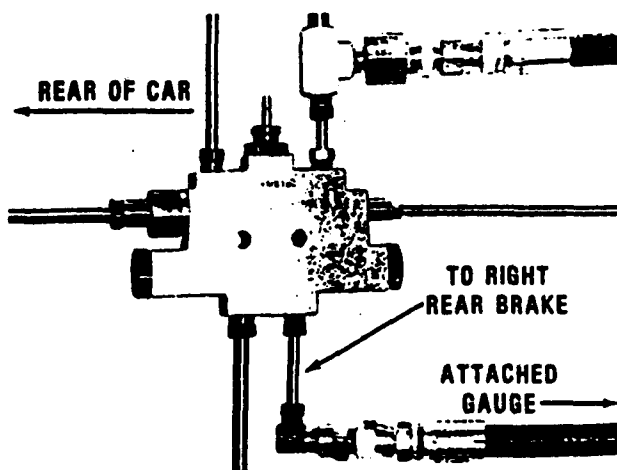


Fig. 18 — Gauge installation to right rear outlet hose.

5. Bleed the hose and gauge.
6. Have a helper depress the brake pedal and hold.
7. If the inlet and outlet pressures do not agree with the values in the chart below (Fig. 19), the valve must be replaced.

Split Point (PSI) Slope	Inlet Pressure from Master Cylinder	Outlet Pressure to Rear Brakes
400/.43	1000	600-700
500/.27	1000	575-700
500/.43	1000	675-750
600/.43	1000	725/825
750/.43	1000	800/900
800/.45	1000	850/950
800/.59	1000	875/950

Fig. 19 — Valve pressure chart.

The proportioning valve delivers full pressure to the rear brakes up to a certain level, called the **split point**. Beyond this point, increasing pressure to the brakes is

reduced according to a certain ratio. Thus, pressure transmitted to both front and rear brakes under light brake pedal application is approximately equal.

4

BRAKE PULSING AND VIBRATION DIAGNOSIS

Brake pulsing and vibration is a common complaint of customers. This condition is easily diagnosed, though many different problems could be the source. Both the front and rear brakes must be tested for rotor or drum surface variation. We will concentrate only on the front brakes.

NOTE: For other possible causes of brake noise, vibrations or pulsing, see the chart appendices at the back of this reference book.

Disc Brake Examination

To test the front disc brakes for runout and thickness, follow this procedure (Fig. 20):

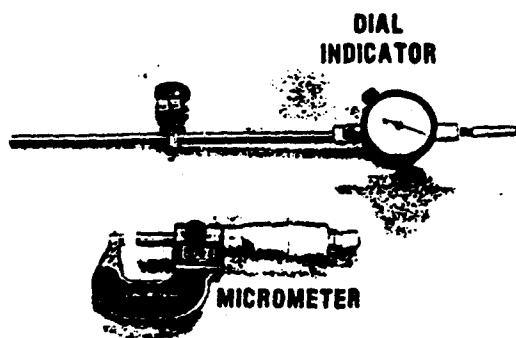


Fig. 20 — Needed tools: dial indicator and micrometer.

1. Remove tire and wheel assembly.
2. With a micrometer, measure the disc thickness. Take a reading at 12 equal points around the disc, about an inch from the edge of the disc (Fig. 21). If thickness measurements vary by more than 13 one-thousandths of a millimeter (.0005 inch), the disc must be replaced or resurfaced. If variation is within specifications, proceed to step 3.
3. Replace lug nuts to tighten the disc to the hub (Fig. 22).



Fig. 21 — Measuring disc thickness.

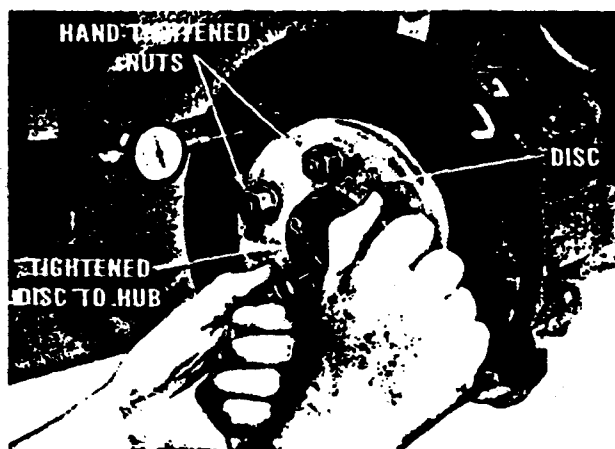


Fig. 22 — Tightening disc to hub.

4. Mount a dial indicator to the steering arm, making sure that the plunger is in contact about one inch from the edge of the disc (Fig. 23).
5. If lateral runout is in excess of 13 one-hundredths of a millimeter (.005 inch), continue to step 6.
6. Make a chalk mark on both the disc and one wheel stud, where the runout was the greatest (Fig. 24).
7. Remove disc.

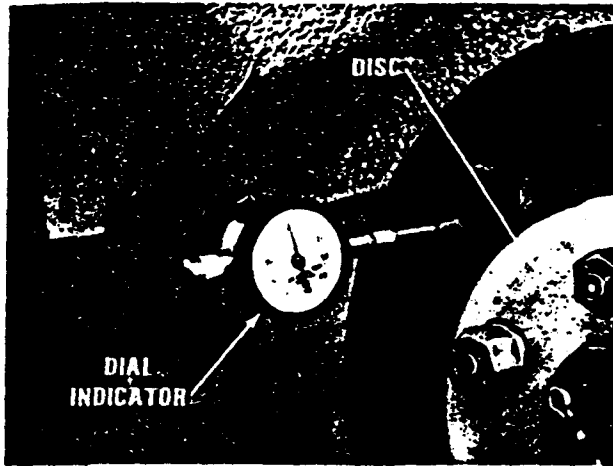


Fig. 23 — Measuring disc runout.

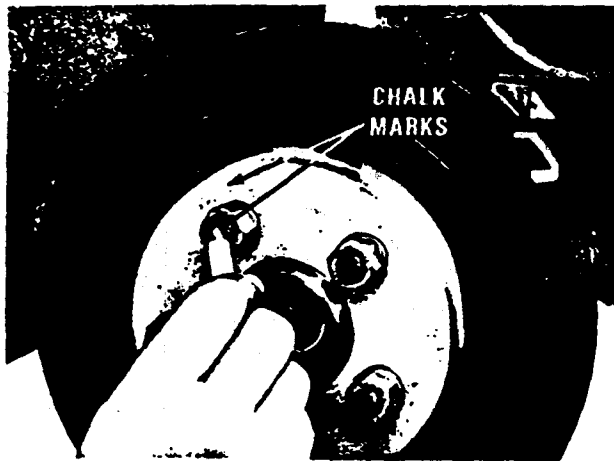


Fig. 24 — Marking disc and wheel stud.

8. Install the dial indicator onto the steering knuckle, making sure the stem is contacting the hub inside of the stud circle (Fig. 25).

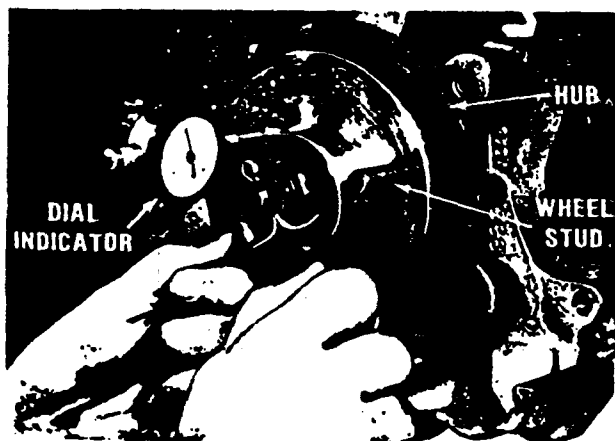


Fig. 25 — Measuring hub runout.

9. If the runout exceeds 8 one-hundredths of a millimeter (.003 inch), replace the hub. If not, proceed to step 10.

10. Reinstall the disc with the two chalk marks opposite one another (Fig. 26).

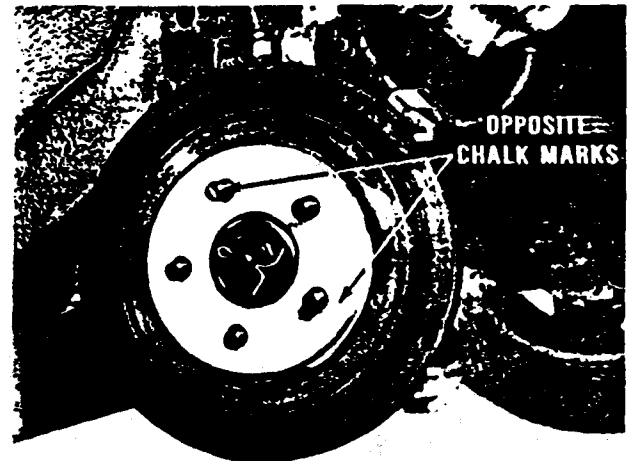


Fig. 26 — Reinstallation of disc.

11. Retest disc runout to make sure the problem has been corrected. If the runout is still in excess of specifications, you must replace or resurface the disc.

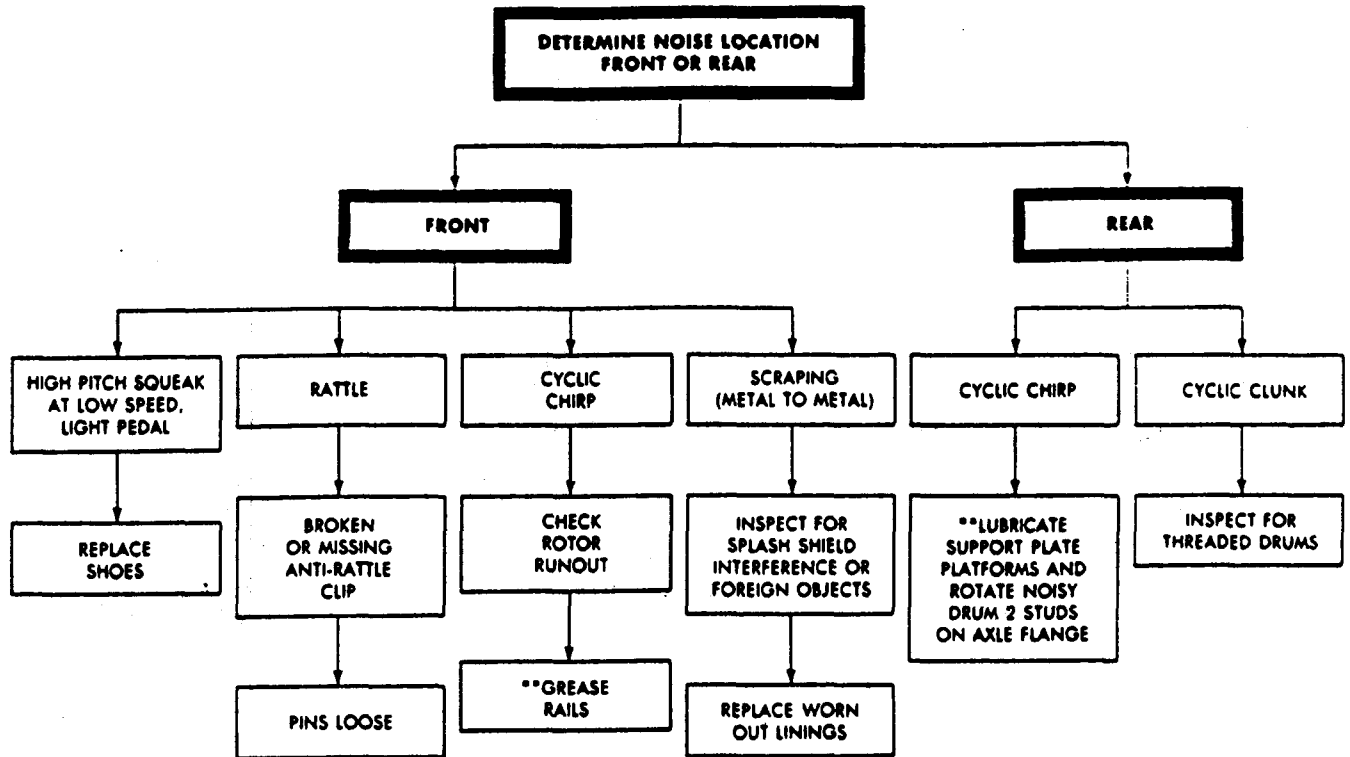
After completing the front brake check, road test the vehicle again to see if the problem still exists. If so, then the rear brakes must be checked. If the vehicle features four-wheel disc brakes, use the same procedure we just completed on the rear discs. And if the rear brakes are drum type, follow the specifications in the service manual.

NOTE: All wheel nuts should be tightened just snug before progressively tightening them to specifications in the sequence described in the service manual.

SUMMARY

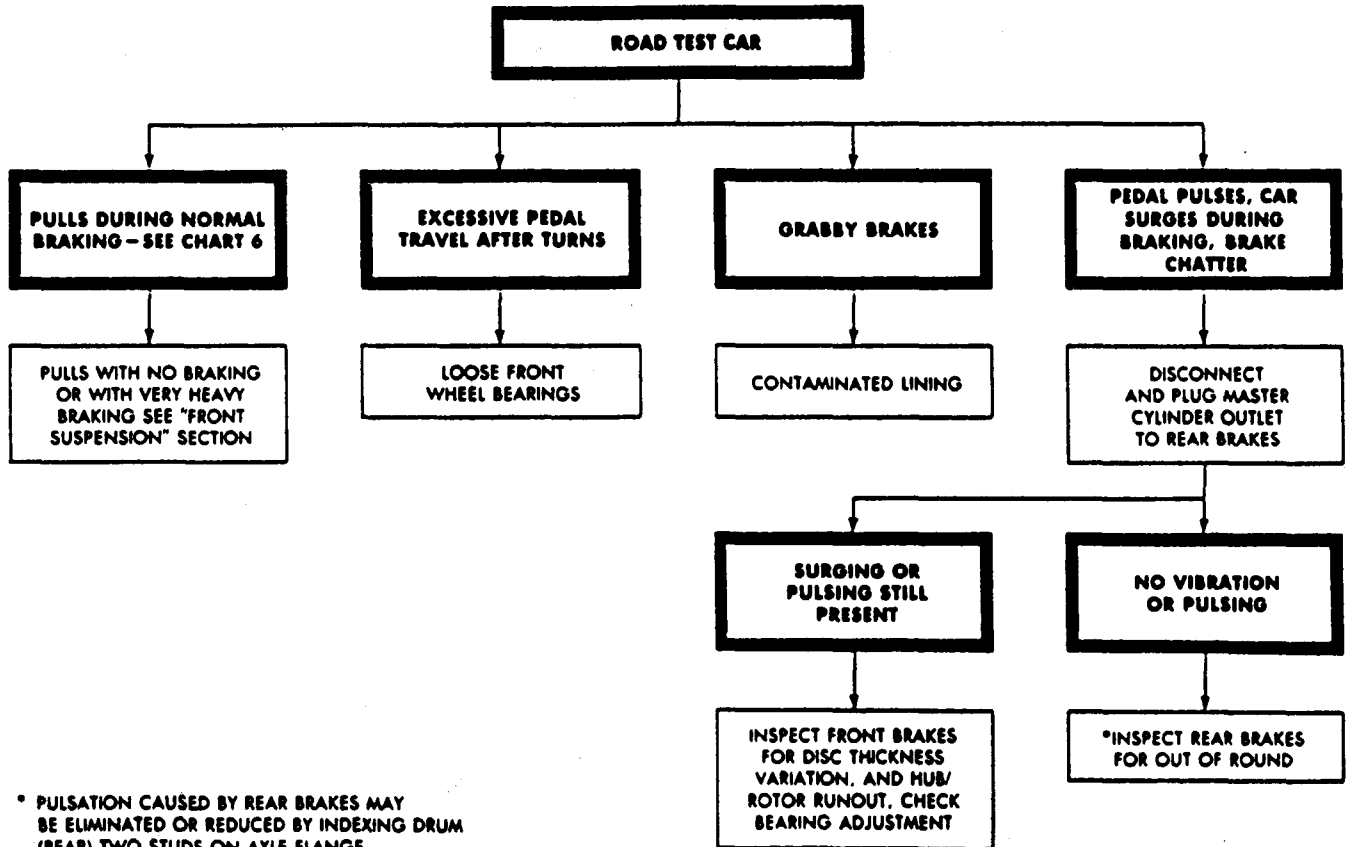
The Rear Wheel Anti-Lock Braking System represents Chrysler's commitment to passenger safety and technological advancement. Its speed sensor, control module, and dual solenoid hydraulic valve act together to help retain the vehicle's directional stability under heavy braking. It is important to understand the way the system works — as well as how to repair any of its problems — so that your customers may get the full benefit of Chrysler's leading-edge technology!

BRAKE CHART 4 BRAKE NOISE DIAGNOSIS



**MOPAR MULTIPURPOSE LUBRICANT, PART NUMBER 4318063, OR EQUIVALENT.

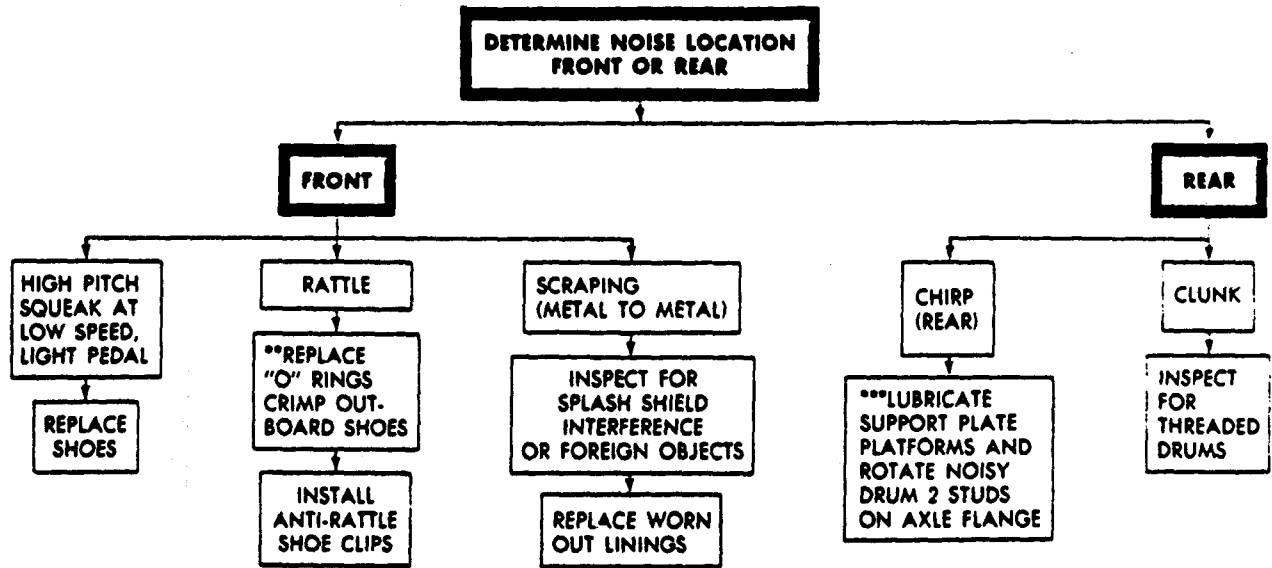
BRAKE CHART 5 WHEEL BRAKES DIAGNOSIS



* PULSATION CAUSED BY REAR BRAKES MAY BE ELIMINATED OR REDUCED BY INDEXING DRUM (REAR) TWO STUDS ON AXLE FLANGE.

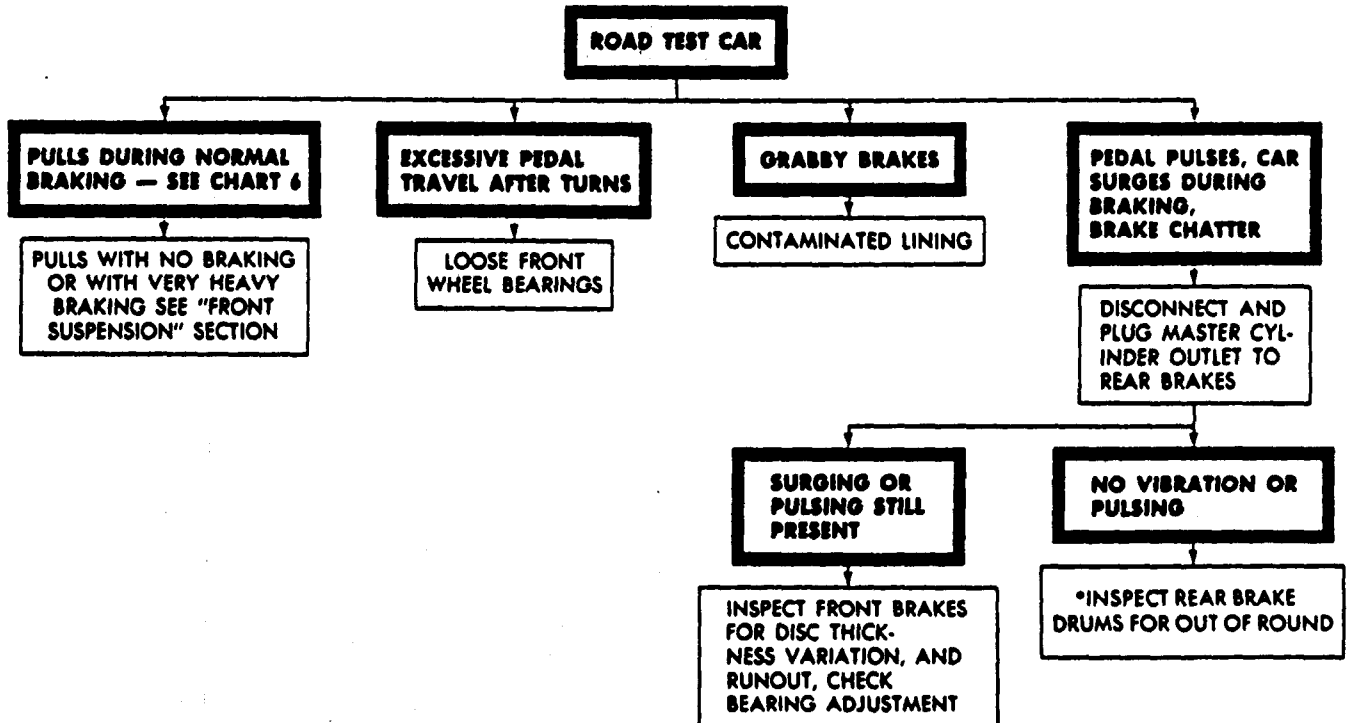
Appendix I — Rear-Wheel-Drive Car Diagnostic Charts

BRAKE CHART 4 BRAKE NOISE DIAGNOSIS



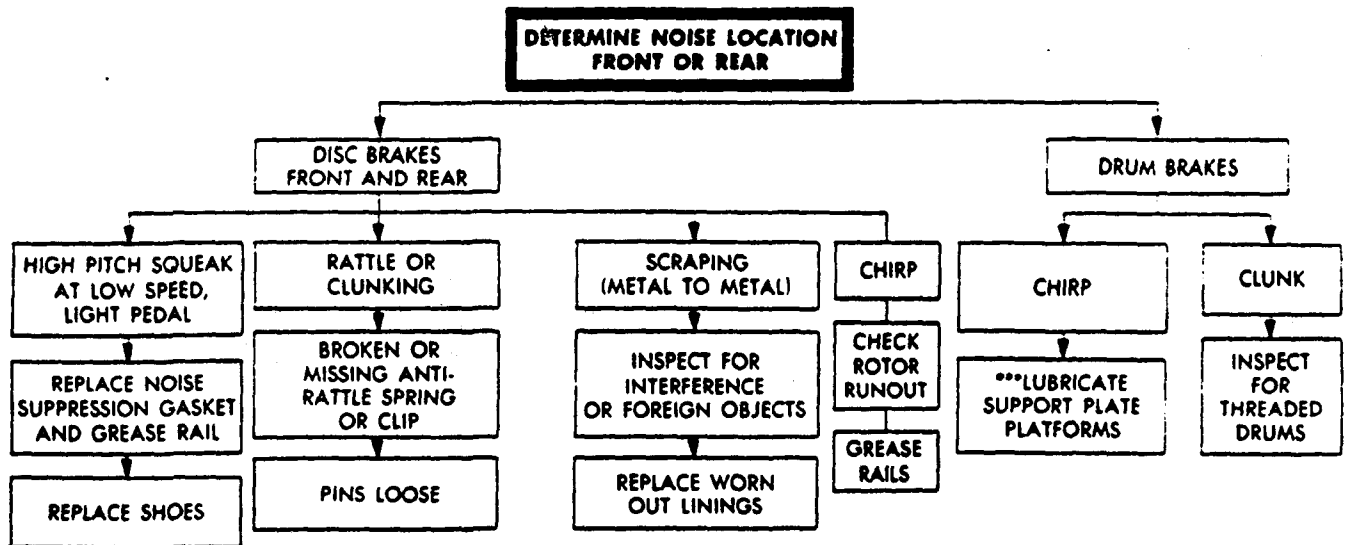
**INSTALL "O" RINGS (AROUND ADAPTER) BETWEEN MACHINED "WAYS" OF CALIPER AND ADAPTER.
 ***MOPAR MULTIPURPOSE LUBRICANT, PART NUMBER 438063, OR EQUIVALENT.

BRAKE CHART 5 WHEEL BRAKES DIAGNOSIS



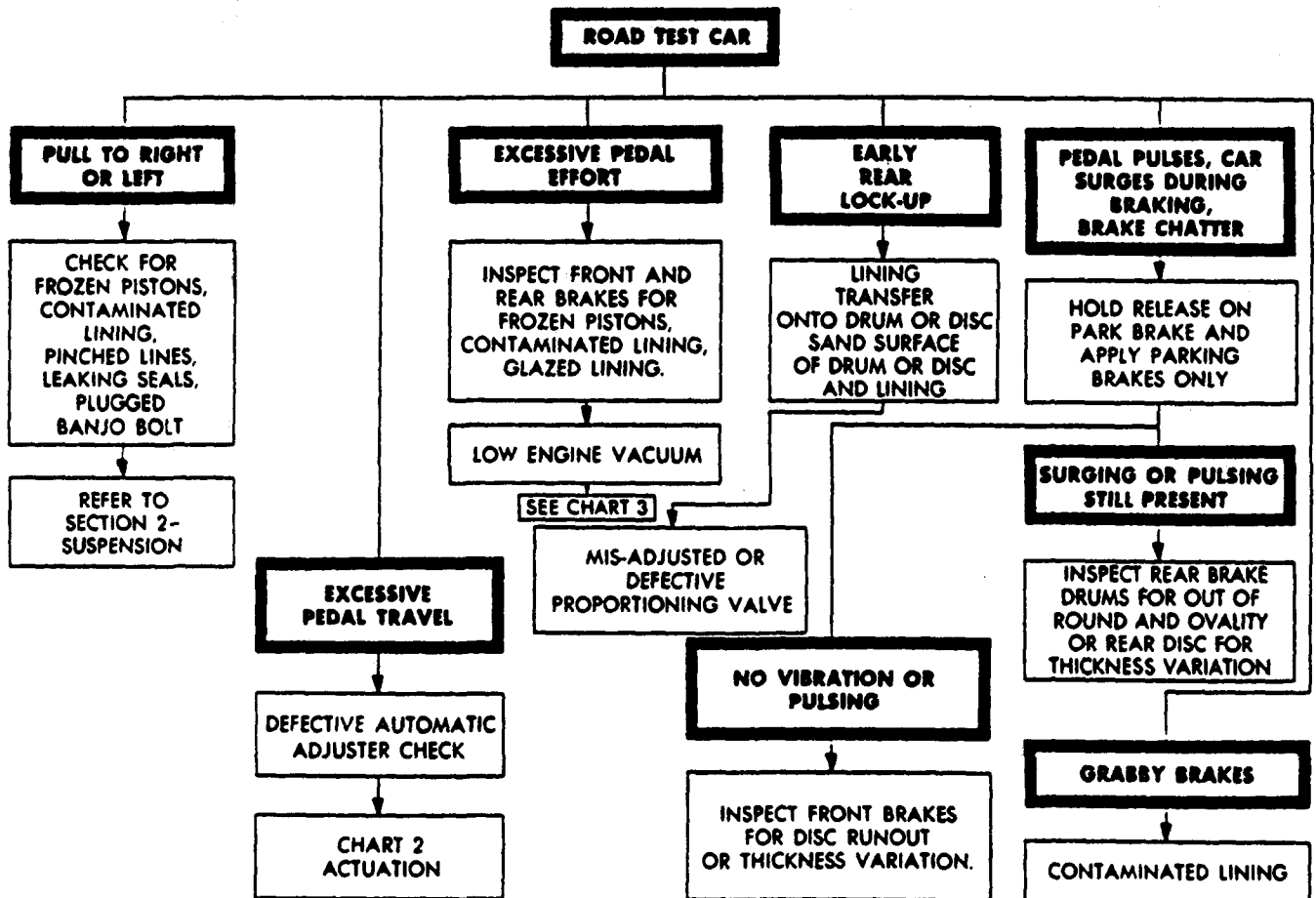
*PULSATION CAUSED BY REAR BRAKES MAY BE ELIMINATED OR REDUCED BY INDEXING DRUM (REAR) TWO STUDS ON AXLE FLANGE.

CHART 4 BRAKE NOISE



***MOPAR MULTIPURPOSE LUBRICANT, PART NUMBER 4318062, OR EQUIVALENT.

CHART 5 WHEEL BRAKES



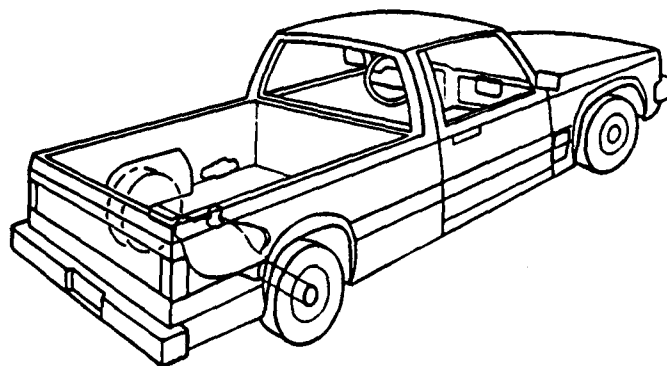
Appendix III — Front-Wheel-Drive Car and Van Diagnostic Charts

THE SERVICE PROFESSIONALS QUESTIONS

INSTRUCTIONS: Questions one through ten are multiple choice. Circle the letter in front of the answer you think is correct. Be sure to write your name in the space provided. After completing the quiz, turn it in to your meeting leader.

NOTE: DO NOT TEAR OFF THIS PAGE

1. Which of the following is *not* one of the three major RWAL components?
 - A. Speed sensor.
 - B. Proportioning valve.
 - C. Electric brake control module.
 - D. Dual solenoid hydraulic valve.
2. When testing for front disc thickness, what must be done if runout is over 13 one-thousandths of a millimeter?
 - A. Disc replacement.
 - B. Disc resurfacing.
 - C. Hub replacement.
 - D. Either "A" or "B."
3. Which of the following is *not* a function of the electronic control module?
 - A. Checks for electrical shorts or opens.
 - B. Stores fault codes.
 - C. Activates the isolation and dump valves.
 - D. All of the above are functions of the control module.
4. During normal braking, the isolation valve is _____, and the dump valve is _____.
 - A. open, open
 - B. open, closed
 - C. closed, open
 - D. closed, closed
5. Which valve is responsible for allowing brake fluid into the accumulator?
 - A. Isolation valve.
 - B. Proportioning valve.
 - C. Dump valve.
 - D. Outlet pressure valve.
6. If the amber RWAL warning light displays eight short flashes and one long flash, what is the stored fault code?
 - A. 6.
 - B. 7.
 - C. 8.
 - D. 9.
7. After repairing an RWAL problem, what must you do to clear the fault code from the control module's memory?
 - A. Ground an RWAL connector for five seconds.
 - B. Test drive the vehicle.
 - C. Press the control module's "clear" button.
 - D. Disconnect the module from battery power.
8. Which of the following RWAL components are serviceable only by replacement?
 - A. Speed sensor.
 - B. Hydraulic valve.
 - C. Control module.
 - D. All of the above.
9. On rear-wheel-drive trucks, how is the proportioning valve separated?
 - A. Front/rear wheels.
 - B. Left front/right front wheels.
 - C. Right rear/left rear wheels.
 - D. Both left/both right wheels.
10. On "D" body trucks, where is the electronic control module located?
 - A. Under the steering column, behind the headlamp switch plate.
 - B. Lower right-hand side cowl.
 - C. On the left frame rail near the rear axle.
 - D. Behind the glove box.



Name: _____

DO NOT TEAR OFF THIS PAGE

Dodge

Service Manual

Models
B-100
B-200
B-300
CB-300
MB-300

Listed below are the various designations comprising the Vehicle Identification Number:

1st and 2nd Digit Truck Model	3rd Digit Series Body Type	4th Digit GVW Class	5th Digit Eng. Displacement Cu. In.	6th Digit Model Year	7th Digit Assembly Plant
B1—B100 B2—B200 B3—B300	0—MB300 Front Section 1—Tradesman Van, 2—Sportsman Wagon, 3—Custom Sportsman Wagon 4—Royal Sportsman Wagon 5—Tradesman Maxivan, 6—Sportsman Maxiwagon, 7—Custom Sportsman Maxiwagon 8—Royal Sportsman Maxiwagon 9—CB300 Kary Van	A—6,000# or less B—6,001# to 10,000#	B—225-1 E—LA318-1 F—360	3—1973	V—Warren X—Missouri

ENGINE AND ENGINE PARTS IDENTIFICATION

Engine serial identification and parts replacement identification information can be located as follows:

No. Cyl.	Displacement	Engine S/N Location	Parts Replacement Information Location
6	225 cu. in.	Right side of block below #1 spark plug	Right side of block below #1 spark plug
8	318 cu. in.	Left front of block below cylinder head	Left front of block with engine number
8	360 cu. in.		

225 cubic inch engines have the serial numbers stamped on the joint face at the right corner, adjacent to number one cylinder bore (Fig. 3).

318 and 360 cubic inch engines have the serial numbers stamped on the front of the block just below the left cylinder head (Fig. 4).

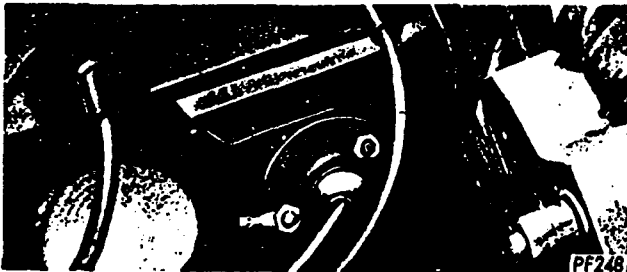


Fig. 3—225 Cubic Inch Engine Identification Number Location

Listed below are the various designations comprising the engine serial identification for the 318 and 360 cubic inch displacement.



Fig. 4—318 and 360 Cubic Inch Engine Identification Number Location

1st and 2nd Digit Model Year and Plant	3rd, 4th and 5th C.I.D.	6th Digit Engine Model	7th, 8th, 9th and 10th Digit Build Date
JM—1973 Mound Rd. JW—1973 Windsor	318 360	R—Regular Fuel	3444—Jan. 1, 1971 3809—Jan. 1, 1972 4175—Jan. 1, 1973

Listed below are the various designations comprising the engine serial identification for the 225 cubic inch displacement.

1st and 2nd Digit Model Year and Truck Engine	3rd, 4th and 5th Digit C.I.D.	NOTE: The numbers shown below the Model Year and cubic inch displacement indicate the Build Date.
J—1973 T—Truck only	225	

See Group 9 of this manual for additional identification information.

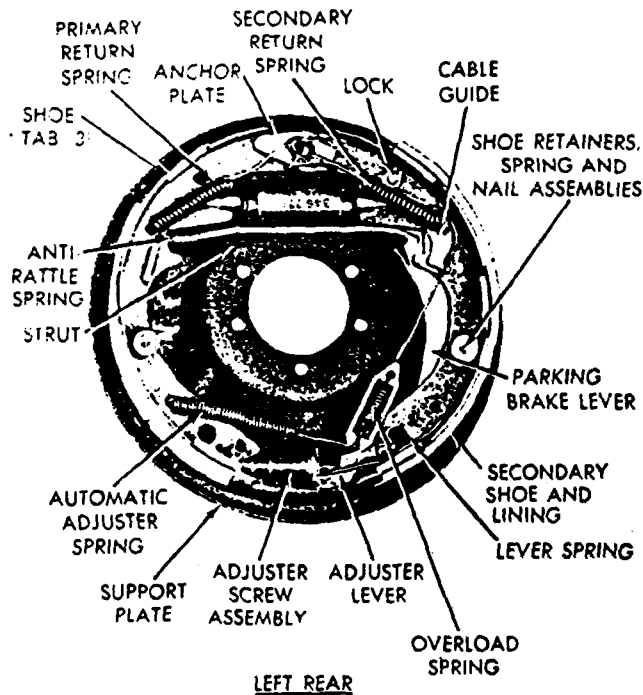


Fig. 2—Eleven Inch Brake Assembly (Rear)

shoes and remove parking brake lever strut and anti-rattle spring. (Fig. 4).

(7) Remove brake shoe retainers, springs and nails. Using Tool C-4070, (Fig. 5), and remove from support.

(8) Disengage parking brake cable from parking brake lever.

CLEANING AND INSPECTION

Wipe or brush clean (dry) the metal portions of

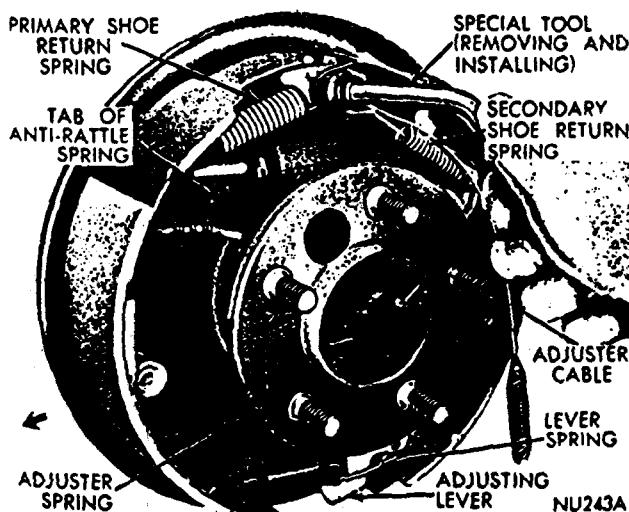


Fig. 3—Removing Shoe Return Springs (Left Rear)

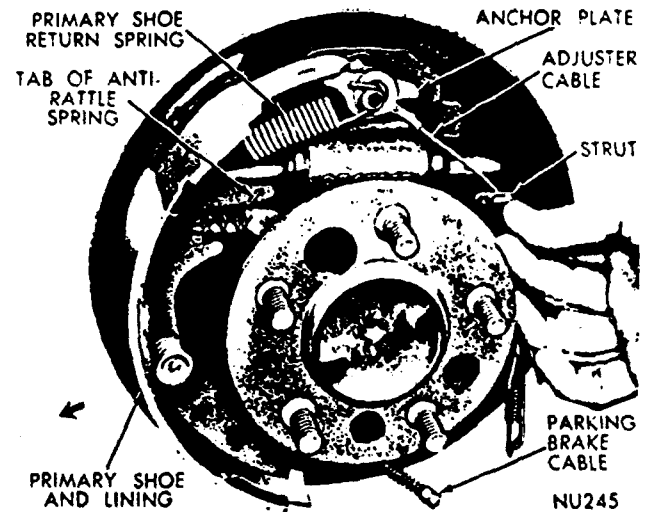


Fig. 4—Removing or Installing a Parking Brake Strut and Spring (Left Rear)

the brake shoes. Examine the lining contact pattern to determine if the shoes are bent. The lining should show contact across the entire width, extending from heel to toe. Shoes showing contact only on one side should be replaced.

Clean the support, using a suitable solvent, then inspect for burrs. Remove if necessary. Clean and inspect the adjusting screws for pulled or stripped threads, then apply a thin film of lubricant to the threads, socket and washer (Fig. 6). Replace adjuster screw if corrosion of any part inhibits very free operation.

New brake shoe return springs and hold down springs should be installed where the old springs have been subjected to overheating or if their strength is questionable. Spring paint discoloration or distorted end coils would indicate an overheated spring.

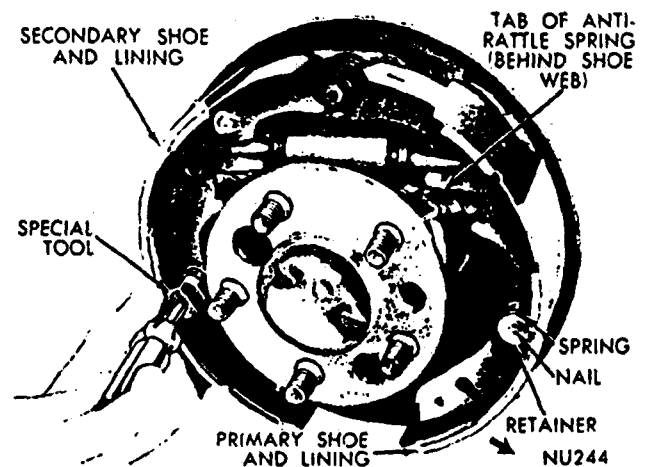


Fig. 5—Removing or Installing Shoe Retainer, Springs and Nails (Right Rear)

The right star wheel is black, and the adjusting stud end is not stamped. Install adjuster spring between shoes. (Eleven inch brakes, install adjuster spring with coil forward, opposite adjuster lever, Fig. 2.)

(8) Install adjusting lever spring over pivot pin on shoe web. Install adjusting lever under spring and over pivot pin. Slide lever slightly rearward to lock in position.

(9) Using Tool C-4070, install shoe retaining nails, retainers and springs. (Fig. 5).

(10) Thread adjuster cable over guide and hook end of overload spring in lever. (Fig. 1 and 2). Be sure eye of cable is pulled tight against anchor and in a straight line with guide).

Installing Rear Brake Drums

(1) Install brake drum. Reinstallation of retaining clips is not necessary. Install wheel and tire assembly.

(2) Adjust brakes as described under "Brake Adjustment" at front of this Group.

BENDIX BX DUO-SERVO BRAKE

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GENERAL INFORMATION

The Bendix BX Duo-Servo is a basic Duo-Servo single anchor brake of an advanced and improved design. These rear brake assemblies include a parking brake lever and cam plate, (Fig. 1) and are self adjusting.

A two-piston wheel cylinder is mounted in an indentation on the support plate. The wheel cylinder must be removed from the support plate for servicing.

Each brake shoe is held against the support plate

by a coil spring-hold down pin combination (Fig. 2).

Each support plate has six guide pads, three for each shoe (Fig. 3). The shoe webs ride against these pads.

Brake shoes are marked pri. (primary) and sec. (secondary) and also "This Side Out" for easy identification and application.

The rear brake assembly is shown in Fig. 4.

SERVICE PROCEDURES

BRAKE DRUM REMOVAL

Rear

(1) Raise vehicle on hoist or jacks and install jack stands for safety.

(2) Remove wheel and tire assembly.

(3) Remove axle shaft nuts, washers and cones. Rap axle shaft sharply in center to release cones if they do not readily release. Remove axle shaft.

(4) Remove outer hub nut. Straighten lock washer, remove it, inner nut and bearing. Carefully remove drum.

CAUTION: If there is interference between brake shoes and drum, remove hole cover and using a screwdriver and light piece of metal, release brake shoes (Fig. 5).

BRAKE SHOES REMOVAL

Rear

(1) Unhook adjusting lever return spring from the

lever (Fig. 1). Remove lever and return spring from lever pivot pin. Unhook adjuster lever from adjuster cable assembly.

(2) Using brake spring pliers (Fig. 6) unhook upper shoe-to-shoe spring. Unhook and remove shoe hold down springs (Fig. 7).

(3) Disconnect parking brake cable from parking brake lever.

(4) Remove shoes with lower shoe-to-shoe spring and starwheel as an assembly (Fig. 8).

CLEANING AND INSPECTION

Wipe or brush clean (dry) the metal portions of the brake shoes. Examine the lining contact pattern to determine if the shoes are bent. The lining should show contact across the entire width, extending from heel to toe. Shoes showing contact only on one side should be replaced.

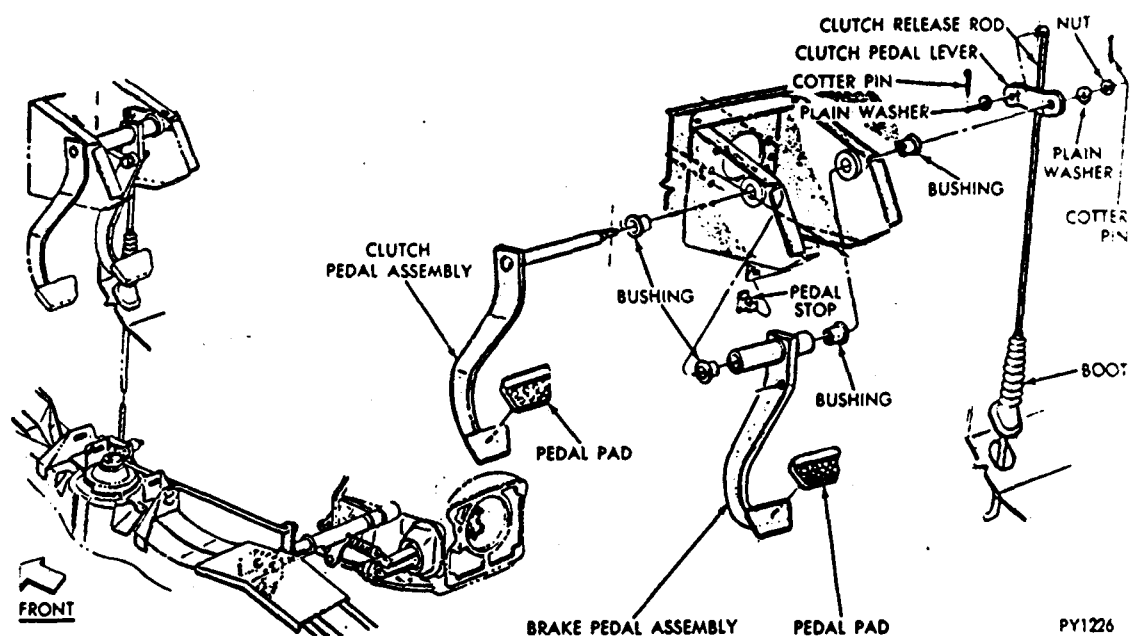


Fig. 2—Clutch Pedal and Linkage

(8) Remove clutch assembly and disc from clutch housing.

CAUTION: Handle clutch and disc carefully to avoid contaminating the friction surfaces.

Cleaning and Inspection

(1) Use compressed air to clean dust out of clutch housing. Inspect for oil leakage through engine rear main bearing oil seal and transmission drive pinion

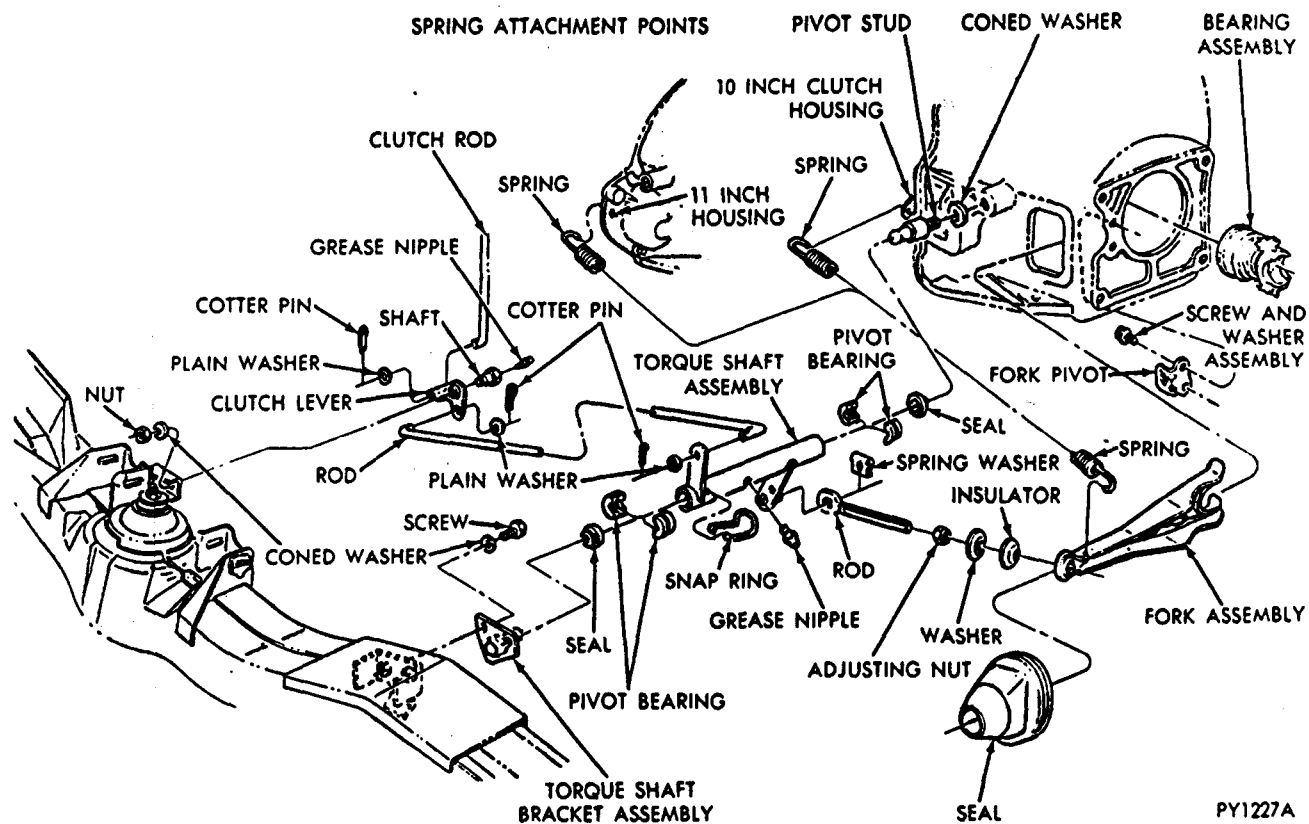


Fig. 3—Torque Shaft and Linkage

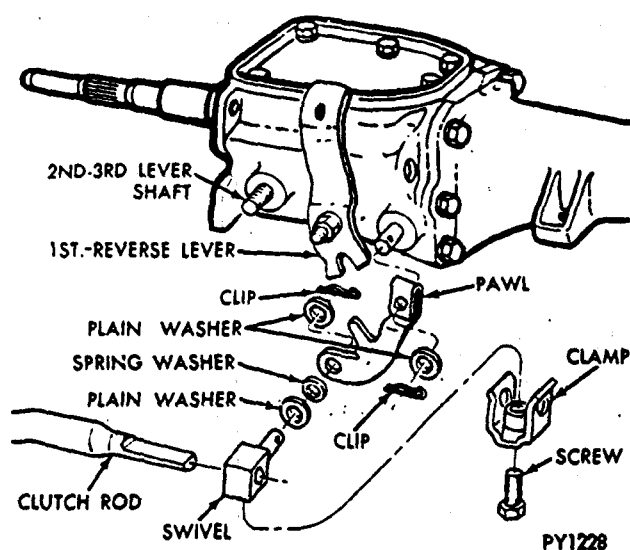


Fig. 4—Gearshift Interlock (A-250 Transmission)

seal. If leakage is noted, it should be corrected at this time.

(2) Friction face of flywheel should have a uniform appearance throughout entire clutch contact area. If there is evidence of heavy contact on one portion of wear circle and a very light contact 180° from that portion, flywheel may be improperly mounted or sprung. In either case, a dial indicator mounted on clutch housing with plunger in contact with wear circle, should show no more than .003 inch runout throughout complete rotation of flywheel.

(3) Friction face of flywheel should also be free from excessive discoloration, burned areas, small cracks, grooves or ridges.

(4) The drive pinion pilot bushing pressed in rear end of crankshaft should be smooth and show no excessive wear. A new transmission main drive pinion can be used to gauge size of bushing.

If necessary to replace bushing, proceed as detailed under "Crankshaft to Transmission Drive Pinion Pilot Bushing."

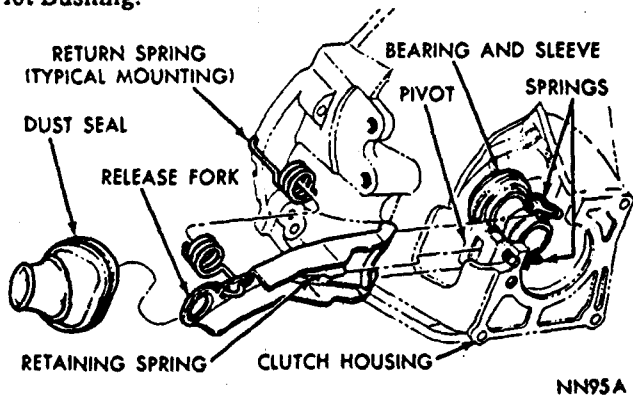


Fig. 5—Clutch Release Fork, Bearing and Sleeve

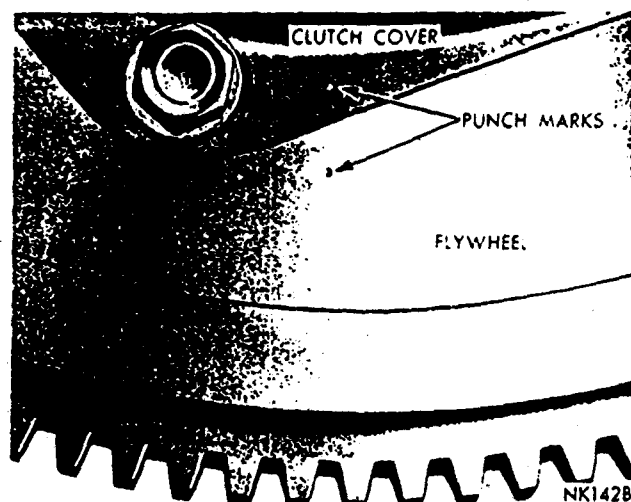


Fig. 6—Marking Clutch and Flywheel

(5) End of transmission main drive pinion should be smooth and bright, without grooves and ridges.

(6) The disc assembly should be handled without touching facings. Replace disc if facings show evidence of grease or oil soakage, or wear to within less than .015 inch of rivet heads. The hub splines and splines on transmission main drive pinion should be a snug fit without signs of excessive wear. Metallic portions of disc assembly should be dry and clean and show no evidence of having been hot. Each of the arched springs between facings should be unbroken and all rivets should be tight.

(7) Wipe friction surface of pressure plate with kerosene, mineral spirits or other suitable solvent.

(8) Using a straight edge, check pressure plate for flatness. The pressure plate friction area should be flat within .020 inch and free from discoloration, burned areas, cracks, grooves or ridges.

(9) Inner ends of release levers should have a uniform wear pattern.

(10) Using a surface plate, test cover for flatness. All sections around attaching bolt holes should be in contact with surface plate within .015 inch.

(11) The cover should be a snug fit on pressure plate lugs. If cover assembly does not meet these requirements, it should be replaced.

(12) Examine condition of clutch release bearing. **CAUTION:** The clutch release bearing is a prelubricated, sealed thrust bearing and should not be immersed in solvent.

The bearing should turn freely when held in the hands under light thrust load, with no evidence of roughness.

(13) If bearing is noisy, rough or dry, install a new one on sleeve as detailed under "Clutch Release Bearing."

CHRYSLER SERVICE MANUAL

B-100, B-200, B-300

DODGE DIVISION



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Service Manual

Ram Van / Wagons

B150

B250

B350



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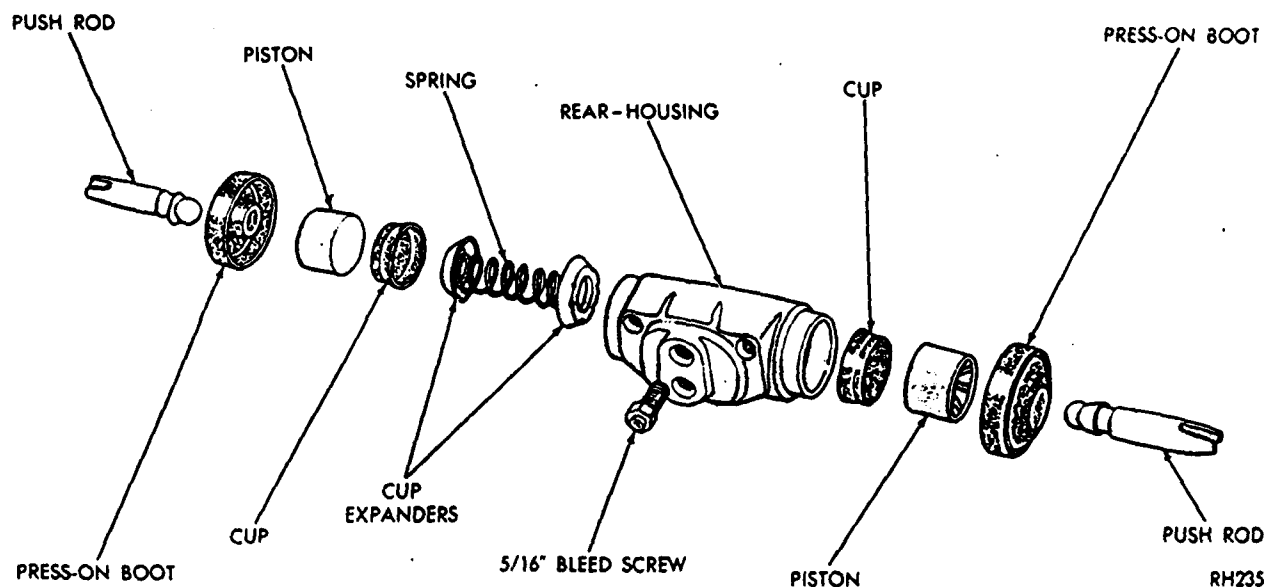


Fig. 2—Rear Wheel Cylinder, 11 and 12 Inch Brakes

DRUM BRAKES — BENDIX**INDEX**

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GENERAL INFORMATION

The Bendix Duo-Servo is a single anchor brake of an advanced and improved design. These rear brake assemblies include a parking brake lever and cam plate (Fig. 1), and are self-adjusting.

A two-piston wheel cylinder is mounted in an indentation on the support plate. The wheel cylinder must be removed from the support plate for servicing.

Each brake shoe is held against the support plate by a coil spring hold-down pin combination (Fig. 2).

Each support plate has six guide pads (Fig. 3). The shoe webs ride against these pads.

Brake shoes are marked "pri". (primary) and "sec".

(secondary) and also "This Side Out" for easy identification and application (Fig. 4).

CAUTION: When servicing brake assemblies or components, do not create dust by sanding, grinding or by cleaning brake parts with a dry brush or with compressed air. A water dampened cloth should be used. Many brake components contain asbestos fibers which can become airborne if dust is created during service operations. Breathing dust which contains asbestos fibers can cause serious bodily harm.

SERVICE PROCEDURES**BRAKE DRUM REMOVAL****Rear**

(1) Raise vehicle on hoist or jacks and install jack stands for safety.

(2) Remove wheel and tire assembly.

(3) Remove axle shaft nuts, washers and cones. Rap axle shaft sharply in center to release cones if they do not readily release. Remove axle shaft.

(4) Remove outer hub nut. Straighten lock washer, remove it, remove inner nut and bearing. Carefully remove drum.

CAUTION: If there is interference between brake shoes and drum, remove hole cover and using screwdriver and light piece of metal, release brake shoes (Fig. 5).

BRAKE SHOES REMOVAL**Rear**

(1) Unhook adjusting lever return spring from the lever (Fig. 1). Remove lever and return spring from lever pivot pin. Unhook adjuster lever from adjuster cable assembly.

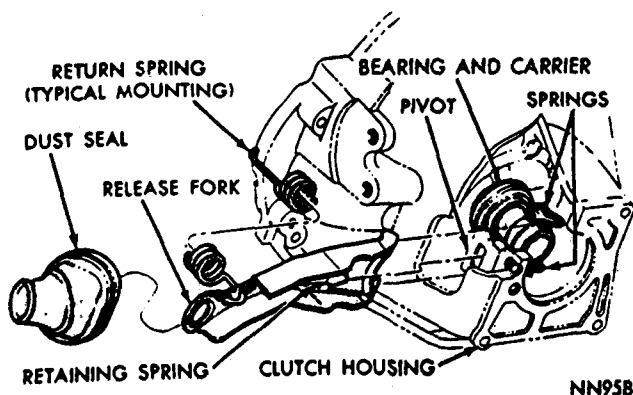


Fig. 4—Release Fork, Bearing, and Carrier

insulator (Fig. 3).

(5) Remove the clutch release bearing and carrier assembly from clutch release fork (Fig. 4) then remove release fork and boot from clutch housing.

(6) Mark clutch cover and flywheel (Fig. 5) to maintain their same relative positions when reinstalling clutch assembly.

(7) Loosen and back off clutch cover attaching bolts, 1 or 2 turns at a time, in succession, to avoid bending cover flange.

(8) Remove clutch assembly and disc from clutch housing.

Cleaning and Inspection

CAUTION: When servicing clutch assemblies or components, do NOT create dust by sanding or by cleaning clutch parts with a dry brush or with compressed air. (A water dampened cloth should be used.) The clutch disc contains "Asbestos Fibers" which can become airborne if dust is created during service operations. Breathing dust containing "Asbestos Fibers" may cause serious bodily harm.

(1) Inspect for oil leakage through engine rear main

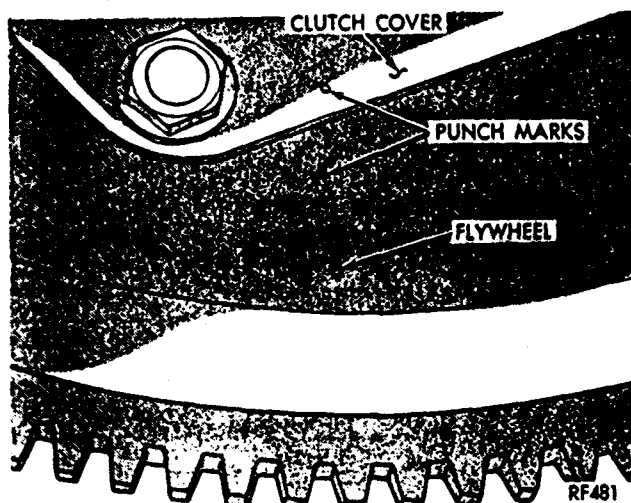


Fig. 5—Clutch and Flywheel Punch Marking

bearing oil seal and transmission drive pinion seal. If leakage is noted, it should be corrected at this time.

(2) Friction face of flywheel should have a uniform appearance throughout entire clutch contact area. If there is evidence of heavy contact on one portion of wear circle and a very light contact 180° from that portion, flywheel may be improperly mounted or sprung. In either case, a dial indicator mounted on clutch housing with plunger in contact with wear circle, should show no more than .003 inch runout throughout complete rotation of flywheel.

(3) Friction face of flywheel should also be free from excessive discoloration, burned areas, small cracks, grooves, or ridges.

(4) The drive pinion pilot bushing, pressed in rear end of crankshaft, should be smooth and show no excessive wear. A new transmission main drive pinion can be used to gauge size of bushing.

If necessary to replace bushing, proceed as detailed under "Crankshaft to Transmission Drive Pinion Pilot Bushing."

(5) End of transmission main drive pinion should be smooth and bright, without grooves and ridges.

(6) The disc assembly should be handled without touching facings. Replace disc if facings show evidence of grease or oil soakage, or wear to within less than .015 inch of rivet heads. The hub splines and splines on transmission main drive pinion should be a snug fit without signs of excessive wear. Metallic portions of disc assembly should be dry and clean and show no evidence of having been hot. Each of the arched springs between facings should be unbroken and all rivets should be tight.

(7) Wipe friction surface of pressure plate with kerosene, mineral spirits, or other suitable solvent.

(8) Using a straightedge, check pressure plate for flatness. The pressure plate friction area should be flat within .020 inch (.508 mm) and free from discoloration, burned areas, cracks, grooves, or ridges.

(9) Inner ends of release levers should have a uniform wear pattern.

(10) Using a surface plate, test cover for flatness. All sections around attaching bolt holes should be in contact with surface plate within .015 inch (.381 mm).

(11) The cover should be a snug fit on pressure plate lugs. If cover assembly does not meet these requirements, it should be replaced.

(12) Examine condition of clutch release bearing. The clutch release bearing is a prelubricated, self-aligning thrust bearing and should not be immersed in solvent.

The bearing should turn freely when held in hands under light thrust load, with no evidence of roughness.

(13) If bearing is noisy, rough, or dry, install a new bearing on carrier as detailed under "Clutch Release Bearing."



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Chassis, Body

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Horizon / Turismo

Rampage

Aries / Reliant

Laser

Daytona

LeBaron

New Yorker

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E Class



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DRUM BRAKES

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Brake Shoe Removal	14	Service Procedures	13

GENERAL INFORMATION

Rear wheel brakes (Fig. 2) are two shoe, internal expanding type with automatic adjusting screw located directly under wheel cylinder.

CAUTION: When servicing brake assemblies or components, do not create dust by sanding, grinding or by cleaning brake parts with a dry brush or with com-

pressed air. A WATER DAMPENED CLOTH SHOULD BE USED. Many brake components contain asbestos fibers which can become airborne if dust is created during service operations. Breathing dust which contains asbestos fibers can cause serious bodily harm.

SERVICE PROCEDURES

BRAKE DRUM

Remove or Install

To allow easier drum removal, loosen up the parking brake cable by backing off the adjusting nut (Fig. 1). Further clearance can be obtained by backing off the brake automatic adjuster screw. Remove plug from the support plate and rotate starwheel with an upward motion, using a screwdriver or an adjuster Tool C-3784.

Remove grease cap (Fig. 2).

Remove cotter pin, lock nut, retaining nut and washer (Fig. 2).

Remove brake drum and bearings (Figs. 2 and 4).

Inspect brake linings for wear, shoe alignment and contamination.

For installation reverse procedure.

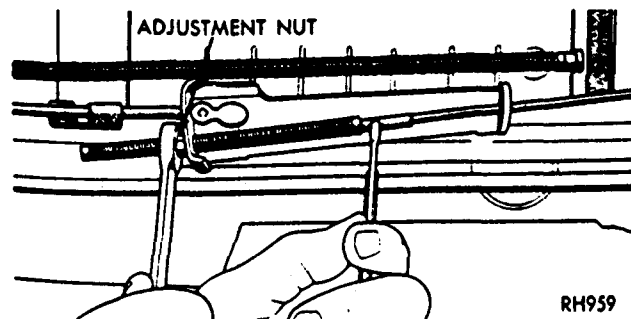
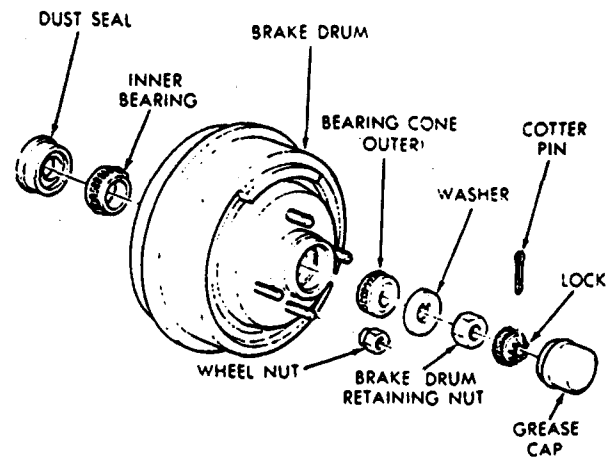


Fig. 1. Loosening Parking Brake Cable



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Fig. 2. Brake Drum and Hub Assembly

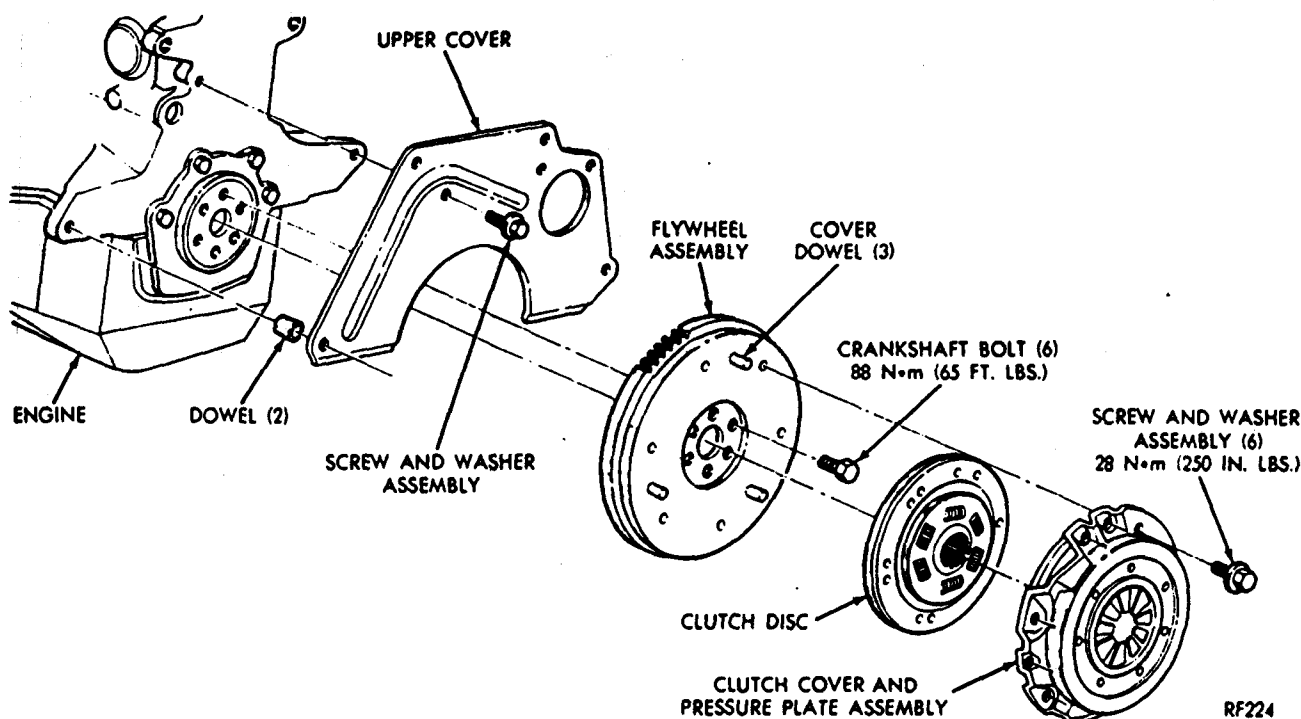


Fig. 3. A-460, A-465, and A-525 Manual Transaxle Clutch—Disassembled (2.2L Engine)

Removal and Installation

(1) Remove or install transaxle. See "Group 21, A-460, A-465, and A-525 Manual Transaxle," for procedure.

(2) Mark clutch cover and flywheel, to maintain their same relative positions when reinstalling clutch assembly.

(3) Insert clutch disc aligning tool C-4676 through the clutch disc hub to prevent the clutch disc from falling and damaging the facings (Fig. 4).

(4) Loosen or tighten clutch cover attaching bolts, one or two turns at a time, in succession, to avoid bending the cover flange (Fig. 2 or 3).

(5) Remove or install the clutch pressure plate and cover assembly and disc from flywheel. Handle carefully to avoid contaminating the friction surfaces.

(6) Remove or install clutch release shaft and slide release bearing assembly off the input shaft seal retainer.

(7) Remove or install the fork from the release bearing thrust plate (see "Release Bearing and Fork" section in Group 21).

(8) To reinstall, reverse the above procedure.

(9) Mount clutch assembly on flywheel, being careful to properly align dowels and the alignment marks made before removal. Apply pressure to the alignment tool to center the tip of the tool into the crankshaft and the sliding cone into the clutch fingers while snugging the clutch attaching bolts sufficiently to hold

the disc in position.

(10) To avoid distortion of the clutch cover, bolts should be tightened a few turns at a time alternately until they are all seated. Tighten to 28 N·m (250 in. lbs.). Remove clutch disc alignment tool.

Cleaning and Inspection

CAUTION: When servicing clutch assemblies or com-

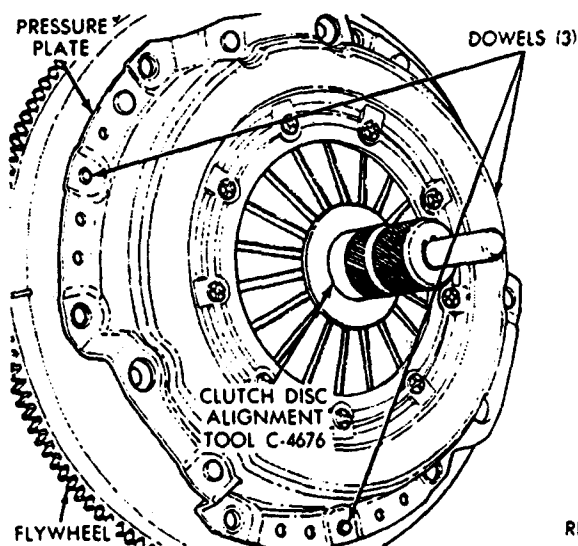


Fig. 4. A-460, A-465, and A-525 Manual Transaxle Clutch Disc Aligning Tool



ponents, do NOT create dust by sanding or by cleaning clutch parts with a dry brush or with compressed air. (A water dampened cloth should be used). The clutch disc contains "Asbestos Fibers" which can become airborne if dust is created during service operations. Breathing dust containing "Asbestos Fibers" may cause serious bodily harm.

(1) Inspect for oil leakage through engine rear main bearing oil seal and transaxle drive pinion seal. If leakage is noted, it should be corrected at this time.

(2) The friction faces of the pressure plate and flywheel should have a uniform appearance throughout the entire disc contact area. If there is evidence of heavy contact on one portion of the wear circle and very light contact 180 degrees from that portion, the flywheel and/or pressure plate may be improperly mounted or sprung. The flywheel should be checked with a dial indicator mounted on the engine with the plunger in contact with the wear circle. It should show no more than .003 inch runout for a complete rotation of the flywheel. Load the crankshaft forward to prevent including crankshaft endplay in runout measurement.

(3) The friction faces of the flywheel and pressure plate should also be free from excessive discoloration, burned areas, small cracks, deep grooves, or ridges.

(4) The disc assembly should be handled without touching the facings. Replace disc if the facings show evidence of grease or oil soakage, or wear to within less than .38 mm (.015 inch) of the rivet heads. The splines on the hub and transaxle shaft should be a snug fit without signs of excessive wear. Metallic portions of disc assembly should be dry and clean, and show no evidence of having been hot. Each of the arched springs between the facings should not be broken and all rivets should be tight.

(5) Wipe the friction surface of the pressure plate with a suitable solvent.

(6) Using a straightedge, check pressure plate for flatness. The pressure plate friction area should be flat within .020 inch and free from discoloration, burned areas, cracks, grooves, or ridges.

(7) Inner ends of the release levers should have a uniform wear pattern.

(8) Using a surface plate, test cover for flatness. All sections around attaching bolt holes should be in contact with surface plate within .015 inch.

(9) The cover should be a snug fit on flywheel dowels. If the clutch assembly does not meet these requirements, it should be replaced.

(10) Examine condition of clutch release bearing. It is a prelubricated and sealed angular contact bearing and should not be immersed in solvent.

The bearing should turn freely when held in the hand under light thrust load with no evidence of

roughness.

(11) If the bearing is noisy, rough, or dry, replace the complete bearing assembly with a new assembly.

RELEASE BEARING AND FORK (Removed from Transaxle)

Removal and Installation

(1) Remove the clutch release shaft and then slide the fork and bearing assembly off the bearing pilot.

(2) Remove the fork from the bearing thrust plate.

(3) Examine the condition of the bearing. It is prelubricated and sealed and should not be immersed in solvent.

(4) The bearing should turn smoothly when held in the hand under a light thrust load. A light drag caused by the lubricant fill is normal. If the bearing is noisy, rough, or dry, replace the complete bearing assembly with a new bearing.

(5) The plastic liner is prelubricated at assembly. If the grease is contaminated, wipe out the old grease and fill the cavities and coat the inner surface of the liner with multipurpose grease. If the liner is cracked or shows signs of heavy wear, replace the bearing assembly.

(6) Check the condition of the spring clips. If the clips are loose or distorted replace the bearing assembly.

(7) Before assembling the fork, lubricate the rounded thrust pads and the spring clip cavities with multipurpose grease.

(8) Assemble the fork to the bearing by sliding the thrust pads under the spring clips. Be careful to avoid distorting the spring clips. These clips prevent the bearing thrust plate from rotating with the bearing.

(9) Slide the bearing and fork assembly onto the bearing pilot.

(10) Position the release shaft bushings in the housing and install the release shaft. Install the retainer clip in the shaft groove near the large bushing.

(11) Install the release lever and retaining clip on the outer end of the release shaft.

CLEANING PRECAUTIONS

Condensation from steam vapors tend to accumulate on the internal clutch mechanism when the vehicle is steam cleaned. The facing of the disc will absorb moisture, and the force exerted by the pressure plate will bond the facings to flywheel and/or pressure plate, if vehicle is allowed to stand for some time before use. If this condition occurs, it will necessitate replacement of disc assembly, flywheel and/or clutch assembly. Immediately after cleaning operation, start engine and drive vehicle to normal clutch operating temperature in order to dry off disc assembly, pressure plate, and flywheel.



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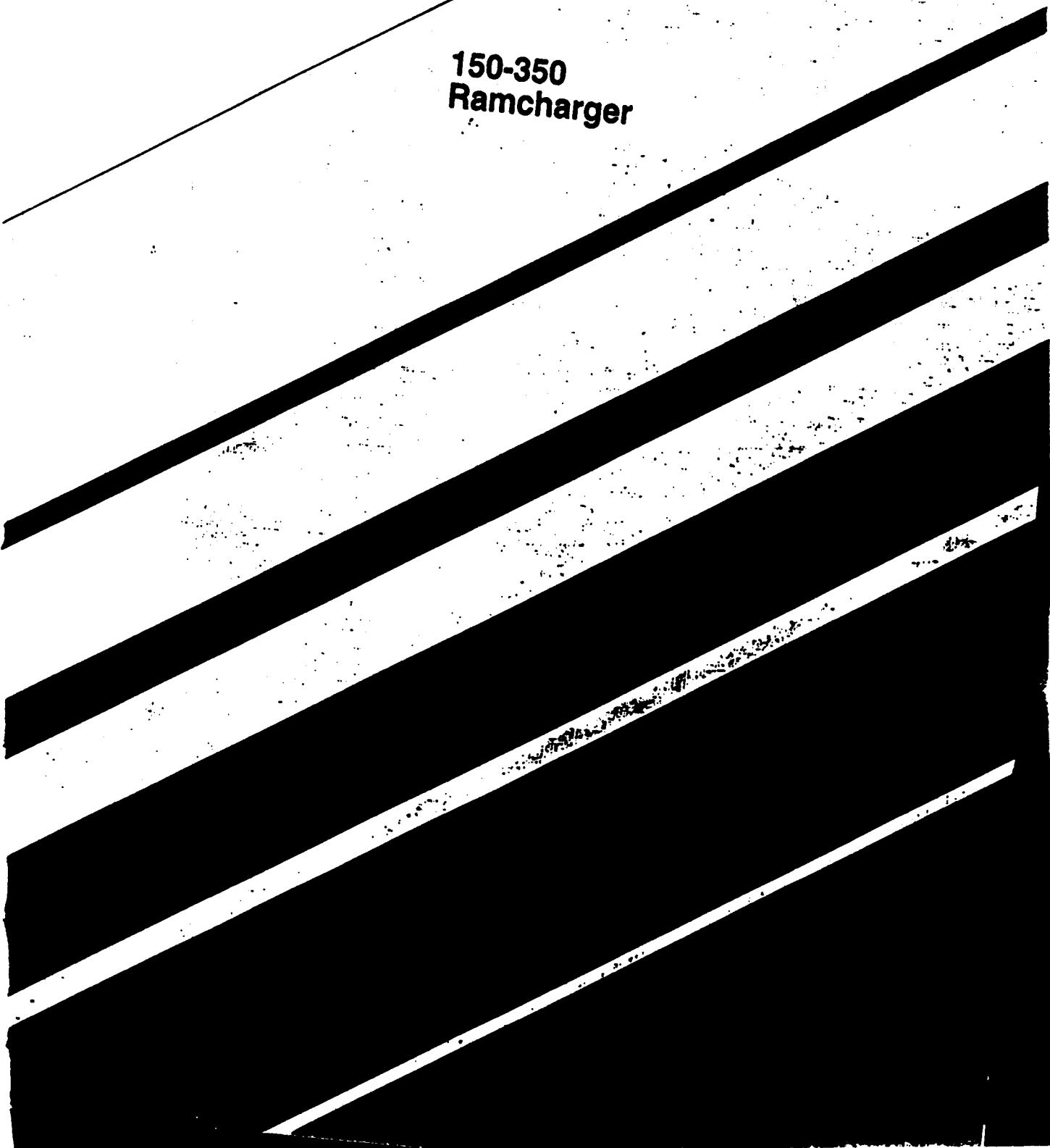
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1982

**Service
Manual**

Truck

**150-350
Ramcharger**

The lower half of the cover features a series of thick, parallel diagonal stripes. These stripes alternate between black and white, creating a strong visual rhythm. The stripes originate from the left side and extend towards the right, with some stripes being slightly longer than others, creating a sense of depth and movement.

inch (.127mm). Drum runout should not exceed .007 inch (.178mm) out of round. If the drum runout or diameter variation exceed these values the drum should be refaced. For best results in eliminating the irregularities that cause brake roughness and surge the amount of material removed during a single cut should be limited to .005 inch (.127mm). When the entire braking surface has been cleaned a final cut of .001 inch (.025mm) will assure a good drum surface providing the equipment used is capable of giving the precision required for resurfacing brake drums. Deeper cuts are permissible for the sole purpose of removing deep score marks.

Do not reface more than .060 inch over the standard drum diameter.

All drums will show markings of maximum allowable diameter. For example, an eleven inch (279mm) drum will have a marking of MAX. DIA 11.090 inch (281mm). This marking includes .030 inch (.762mm) for allowable drum wear beyond the recommended .060 inch (1.52mm) of drum refacing.

CLEANING AND INSPECTION

Wipe or brush clean (dry) the metal portions of the brake shoes. Examine the lining contact pattern to determine if the shoes are bent. The lining should show contact across the entire width, extending from heel to toe. Shoes showing contact only on one side should be replaced. Shoes having sufficient lining but lack of contact at toe and heel should be measured for proper grind.

Clean the support, using a suitable solvent, then inspect for burrs. Remove if necessary. Clean the threads of the adjusting screws, then inspect for pulled or stripped threads.



Fig. 6—Removing or Installing Upper Shoe to Shoe Spring (Rear)



Fig. 7—Removing or Installing Shoe Hold Down Springs (Rear)

BRAKE SHOE INSTALLATION

Rear

Pivot screw and adjusting nut have left hand threads on left brake assemblies (brakes on left side of the vehicle) and right hand threads on right hand assemblies (brakes on right side of the vehicle).

(1) Lubricate and assemble starwheel assembly. Lubricate guide pads on support plates (Fig. 3) with MOPAR Multi-Purpose lubricant Part Number 2932524 or equivalent.

(2) Assemble starwheel, lower shoe-to-shoe spring and primary and secondary shoe and position on support plate (Fig. 8).



Fig. 8—Removing or Installing Shoe Assembly (Rear)



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Condition	Possible Cause	Correction
CLUTCH SLIPPING	(a) Burned, worn, or oil soaked facings.	(a) Replace disc assembly and correct cause of contamination.
	(b) Insufficient pedal free play.	(b) Adjust release fork rod.
	(c) Weak or broken pressure springs.	(c) Replace cover assembly.
DIFFICULT GEAR SHIFTING	(a) Excessive pedal free play.	(a) Adjust release fork rod.
	(b) Excessive deflection in linkage or firewall.	(b) Repair or replace linkage.
	(c) Worn or damaged disc assembly.	(c) Replace disc assembly.
	(d) Improperly adjusted cover assembly.	(d) Replace cover assembly.
	(e) Clutch disc splines sticking.	(e) Remove disc assembly and free up splines or replace disc.
	(f) Worn or dry pilot bushing.	(f) Lubricate or replace bushing.
CLUTCH NOISY	(g) Clutch housing misaligned.	(g) Align clutch housing.
	(a) Dry clutch linkage.	(a) Lubricate where necessary.
	(b) Worn release bearing.	(b) Replace release bearing.
	(c) Worn disc assembly.	(c) Replace disc assembly.
	(d) Worn release levers.	(d) Replace cover assembly.
	(e) Worn or dry pilot bushing.	(e) Lubricate or replace bushing.
	(f) Dry contact at pressure plate lugs in cover.	(f) Lubricate very lightly.

SERVICE PROCEDURES

Improper operation or excessive wear may impair clutch function to a point where it may be necessary to remove and replace disc and/or cover assembly. Handle clutch and disc carefully to avoid contaminating friction surfaces.

Removal

- (1) Remove transfer case (if so equipped). See Group 21.
- (2) Remove transmission. See Group 21.
- (3) Remove clutch housing pan.
- (4) Disconnect return spring from clutch release

fork and clutch housing.

(5) Remove fork rod assembly spring washer from pin and remove rod with adjusting nut, washer, and insulator.

(6) Remove clutch release bearing and carrier assembly from clutch release fork then remove release fork and boot from clutch housing (Fig. 3).

(7) Mark clutch cover and flywheel to maintain their same relative positions when reinstalling clutch assembly (Fig. 4).

(8) Loosen and back off clutch cover attaching bolts, one or two turns at a time, in succession, to avoid bending cover flange.

(9) Remove clutch assembly and disc from clutch housing.

Cleaning and Inspection

(1) Clean clutch dust from clutch housing with vacuum brush or shop towel. Do not use compressed air. Inspect for oil leakage through engine rear main bearing oil seal and transmission drive pinion seal. If leak-

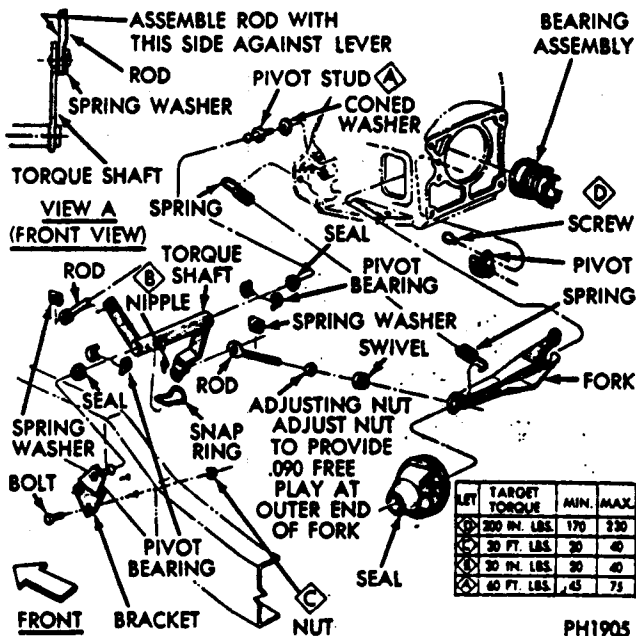


Fig. 2—Torque Shaft and Linkage

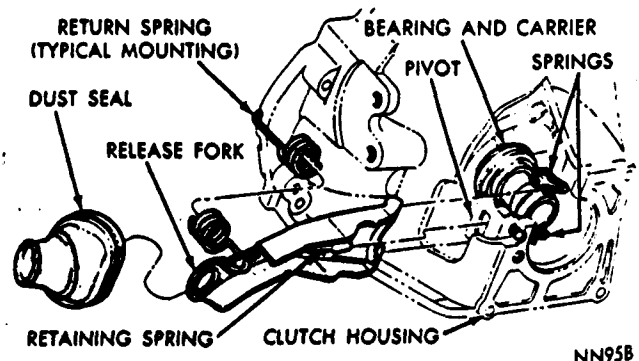


Fig. 3—Release Fork, Bearing, and Carrier

1

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8

5

ENGINE/CHASSIS/BODY

OMNI/CHARGER
HORIZON/TURISMO
ARIES
RELIANT
LASER
DAYTONA
LE BARON
NEW YORKER
600
CARAVELLE
LANCER
LE BARON GTS

CHRYSLER
CORPORATION*Service Manual*



DRUM BRAKES

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GENERAL INFORMATION

Rear wheel brakes (Fig. 2) are two shoe, internal expanding type with automatic adjusting screw located directly under wheel cylinder.

CAUTION: When servicing brake assemblies or components, do not create dust by sanding, grinding or by cleaning brake parts with a dry brush or with com-

pressed air. A WATER DAMPENED CLOTH SHOULD BE USED. Many brake components contain asbestos fibers which can become airborne if dust is created during service operations. Breathing dust which contains asbestos fibers can cause serious bodily harm.

SERVICE PROCEDURES

BRAKE DRUM REMOVAL AND INSTALLATION

To allow easier drum removal, loosen up the parking brake cable by backing off the adjusting nut (see "Adjusting Parking Brake"). Further clearance can be obtained by backing off the brake automatic adjuster screw. Remove plug from the support plate and rotate starwheel with an upward motion, using a screwdriver or an adjuster Tool C-3784.

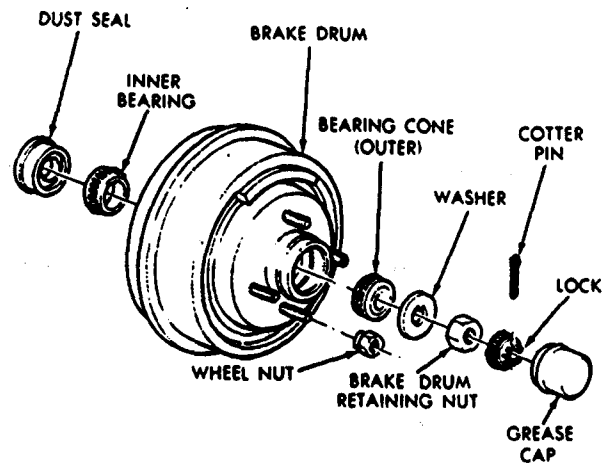
Remove grease cap (Fig. 1).

Remove cotter pin, lock nut, retaining nut and washer (Fig. 1).

Remove brake drum and bearings (Figs. 1 and 3).

Inspect brake linings for wear, shoe alignment and contamination.

For installation reverse procedure.



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Fig. 1—Brake Drum and Hub Assembly

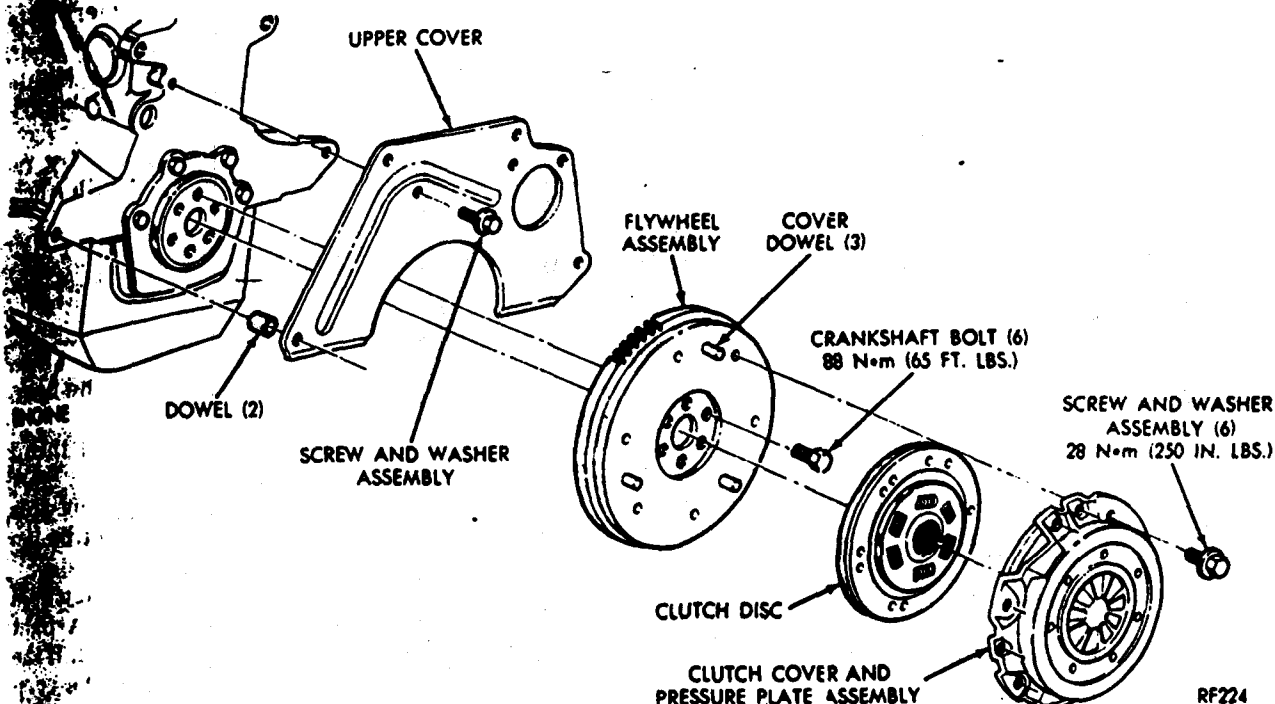


Fig. 3—A-460 and A-525 Manual Transaxle Clutch—Disassembled (2.2L Engine)

Removal and Installation

(1) Remove or install transaxle. See "Group 11 Manual Transaxle," for procedure.

(2) Mark clutch cover and flywheel, to maintain their same relative positions when reinstalling clutch assembly.

(3) Insert Clutch Disc Aligning Tool C-4676 through the clutch disc hub to prevent the clutch from falling and damaging the facings (Fig. 4).

(4) Loosen or tighten clutch cover attaching bolts one or two turns at a time, in succession, to avoid bending the cover flange (Figs. 2 or 3).

(5) Remove or install the clutch pressure plate cover assembly and disc from flywheel. Handle carefully to avoid contaminating the friction surfaces.

(6) Remove or install clutch release shaft and the release bearing assembly off the input shaft retainer.

(7) Remove or install the fork from the release bearing thrust plate (see "Release Bearing and Fork" section in Group 21).

(8) To reinstall, reverse the above procedure.

(9) Mount clutch assembly on flywheel, being careful to properly align dowels and the alignment marks made before removal. Apply pressure to alignment tool to center the tip of the tool on the crankshaft and the sliding cone into the fingers while snugging the clutch attaching bolts sufficiently to hold the disc in position.

(10) To avoid distortion of the clutch cover, bolts should be tightened a few turns at a time alternately until they are all seated. Tighten to 28 N·m (250 in. lbs.). Remove clutch disc alignment tool.

Cleaning and Inspection

WARNING: WHEN SERVICING CLUTCH ASSEMBLIES OR COMPONENTS, DO NOT CREATE DUST BY SAND-

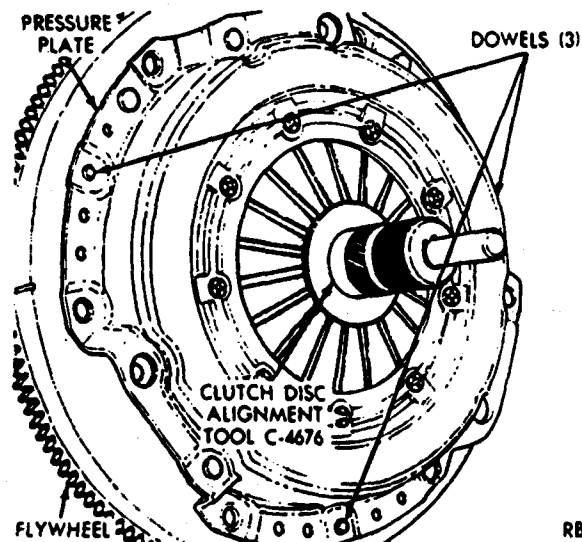


Fig. 4—Manual Transaxle Clutch Disc Aligning Tool



NG OR BY CLEANING CLUTCH PARTS WITH A DRY BRUSH OR WITH COMPRESSED AIR. (A WATER DAMPENED CLOTH SHOULD BE USED). THE CLUTCH DISC MAY CONTAIN "ASBESTOS FIBERS" WHICH CAN BECOME AIRBORNE IF DUST IS CREATED DURING SERVICE OPERATIONS. BREATHING DUST CONTAINING "ASBESTOS FIBERS" MAY CAUSE SERIOUS BODILY HARM.

(1) Inspect for oil leakage through engine rear main bearing oil seal and transaxle drive pinion seal. If leakage is noted, it should be corrected at this time.

(2) The friction faces of the pressure plate and flywheel should have a uniform appearance throughout the entire disc contact area. If there is evidence of heavy contact on one portion of the wear circle and very light contact 180 degrees from that portion, the flywheel and/or pressure plate may be improperly mounted or sprung. The flywheel should be checked with a dial indicator mounted on the engine with the plunger in contact with the wear circle. It should show no more than .003 inch runout for a complete rotation of the flywheel. Load the crankshaft forward to prevent including crankshaft endplay in runout measurement.

(3) The friction faces of the flywheel and pressure plate should also be free from excessive discoloration, burned areas, small cracks, deep grooves, or ridges.

(4) The disc assembly should be handled without touching the facings. Replace disc if the facings show evidence of grease or oil soakage, or wear to within less than .38 mm (.015 inch) of the rivet heads. The splines on the hub and transaxle shaft should be a snug fit without signs of excessive wear. Metallic portions of disc assembly should be dry and clean, and show no evidence of having been hot. Each of the arched springs between the facings should not be broken and all rivets should be tight.

(5) Wipe the friction surface of the pressure plate with a suitable solvent.

(6) Using a straightedge, check pressure plate for flatness. The pressure plate friction area should be flat within .020 inch and free from discoloration, burned areas, cracks, grooves, or ridges.

(7) Inner ends of the release levers should have a uniform wear pattern.

(8) Using a surface plate, test cover for flatness. All sections around attaching bolt holes should be in contact with surface plate within .015 inch.

(9) The cover should be a snug fit on flywheel dowels. If the clutch assembly does not meet these requirements, it should be replaced.

(10) Examine condition of clutch release bearing. It is a prelubricated and sealed angular con-

tact bearing and should not be immersed in solvent.

The bearing should turn freely when held in the hand under light thrust load with no evidence of roughness.

(11) If the bearing is noisy, rough, or dry, replace the complete bearing assembly with a new assembly.

RELEASE BEARING AND FORK (Removed from Transaxle)

Removal and Installation

(1) Remove the clutch release shaft and then slide the fork and bearing assembly off the bearing pilot.

(2) Remove the fork from the bearing thrust plate.

(3) Examine the condition of the bearing. It is prelubricated and sealed and should not be immersed in solvent.

(4) The bearing should turn smoothly when held in the hand under a light thrust load. A light drag caused by the lubricant fill is normal. If the bearing is noisy, rough, or dry, replace the complete bearing assembly with a new bearing.

(5) The plastic liner is prelubricated at assembly. If the grease is contaminated, wipe out the old grease and fill the cavities and coat the inner surface of the liner with multipurpose grease. If the liner is cracked or shows signs of heavy wear, replace the bearing assembly.

(6) Check the condition of the spring clips. If the clips are loose or distorted, replace the bearing assembly.

(7) Before assembling the fork, lubricate the rounded thrust pads and the spring clip cavities with multipurpose grease.

(8) Assemble the fork to the bearing by sliding the thrust pads under the spring clips. Be careful to avoid distorting the spring clips. These clips prevent the bearing thrust plate from rotating with the bearing.

(9) Slide the bearing and fork assembly onto the bearing pilot.

(10) Position the release shaft bushings in the housing and install the release shaft. Install the retainer clip in the shaft groove near the large bushing.

(11) Install the release lever and retaining clip on the outer end of the release shaft.

CLEANING PRECAUTIONS

Condensation from steam vapors tend to accumulate on the internal clutch mechanism when the vehicle is steam cleaned. The facing of the disc will absorb moisture, and the force exerted by the pressure plate will bond the facings to

DRUM BRAKES — CHRYSLER

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GENERAL INFORMATION

All drum brake applications are two shoe, internal expanding brakes with application adjusters. The lower ends of the brake shoes are connected by a tubular star wheel adjusting screw (Figs. 1 and 2).

CAUTION: When servicing brake assemblies or components, do not create dust by sanding, grinding or by cleaning brake parts with a dry brush or with

compressed air. A water dampened cloth should be used. Many brake components contain asbestos fibers which can become airborne if dust is created during service operations. Breathing dust which contains asbestos fibers can cause serious bodily harm.

SERVICE PROCEDURES

BRAKE DRUM REMOVAL

(1) Remove rear plug from brake adjusting access hole.

(2) Insert a thin screwdriver into brake adjusting hole and hold adjusting lever away from notches of adjusting screw.

(3) Insert Tool C-3784 into brake adjusting hole and engage notches of brake adjusting screw. Release

brake by prying down with adjusting tool.

(4) Remove rear wheel and clips from wheel studs that holds drum on axle. Discard clips. Remove drums.

(5) Inspect brake lining for wear, shoe alignment, or contamination from grease or brake fluid.

BRAKE SHOE REMOVAL

(1) Remove brake drum.

(2) Using Tool C-3785, remove brake shoe return springs (Fig. 2). (Note how secondary shoe return spring overlaps primary shoe return spring) (Fig. 1).

(3) Slide eye of automatic adjuster cable off anchor and then unhook from adjusting lever. Remove cable assembly, cable guide, and anchor plate.

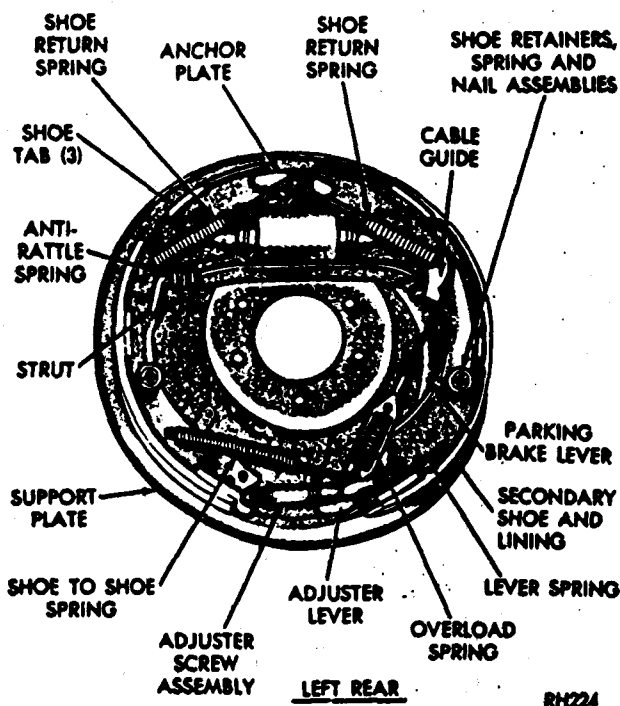


Fig. 1—Eleven Inch Brake Assembly

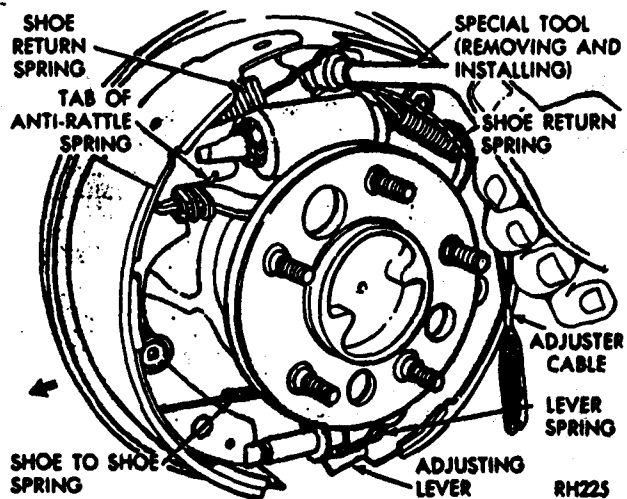


Fig. 2—Removing Shoe Return Springs

(4) Disconnect return spring from clutch release fork and clutch housing.

(5) Remove fork rod assembly spring washer from pin and remove rod with adjusting nut, washer, and insulator.

(6) Remove clutch release bearing and carrier assembly from clutch release fork then remove release fork and boot from clutch housing (Fig. 3).

(7) Mark clutch cover and flywheel to maintain their same relative positions when reinstalling clutch assembly (Fig. 4).

(8) Loosen and back off clutch cover attaching bolts, one or two turns at a time, in succession, to avoid bending cover flange.

(9) Remove clutch assembly and disc from clutch housing.

Cleaning and Inspection

WARNING: WHEN SERVICING CLUTCH ASSEMBLIES OR COMPONENTS, DO NOT CREATE DUST BY SANDING OR BY CLEANING CLUTCH PARTS WITH A DRY BRUSH OR WITH COMPRESSED AIR. (A WATER DAMPENED CLOTH SHOULD BE USED). THE CLUTCH DISC MAY CONTAIN "ASBESTOS FIBERS" WHICH CAN BECOME AIRBORNE IF DUST IS CREATED DURING SERVICE OPERATIONS. BREATHING DUST CONTAINING "ASBESTOS FIBERS" MAY CAUSE SERIOUS BODILY HARM.

(1) Inspect for oil leakage through engine rear main bearing oil seal and transmission drive pinion seal. If leakage is noted, it should be corrected at this time.

(2) Friction face of flywheel should have a uniform appearance throughout entire clutch contact area. If there is evidence of heavy contact on one portion of wear circle and a very light contact 180° from that portion, flywheel may be improperly mounted or sprung. In either case, a dial indicator mounted on clutch housing with plunger in contact with wear circle, should show no more than .003 inch runout throughout complete rotation of flywheel.

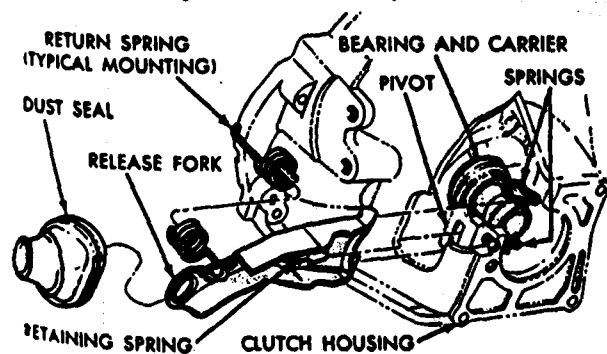


Fig. 3—Release Fork, Bearing, and Carrier

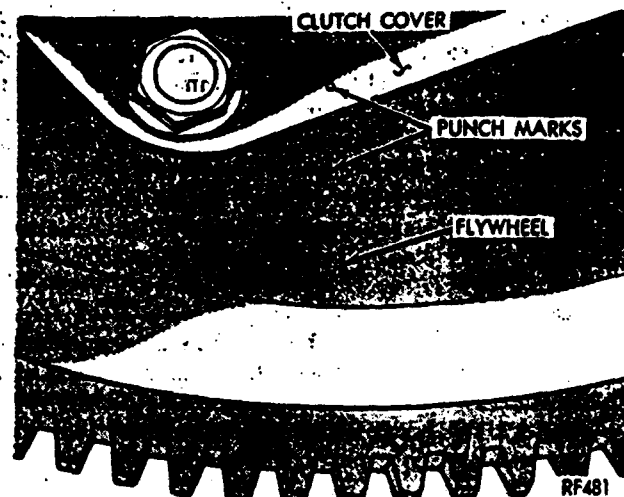


Fig. 4—Clutch and Flywheel Marking

(3) Friction face of flywheel should also be free from excessive discoloration, burned areas, small cracks, grooves, or ridges.

(4) The drive pinion pilot bushing, pressed in rear end of crankshaft, should be smooth and show no excessive wear. A new transmission main drive pinion can be used to gauge size of bushing.

If necessary to replace bushing, proceed as detailed under "Crankshaft to Transmission Drive Pinion Pilot Bushing."

(5) End of transmission main drive pinion should be smooth and bright, without grooves and ridges.

(6) The disc assembly should be handled without touching facings. Replace disc if facings show evidence of grease or oil soakage, or wear to within less than .015 inch of rivet heads. The hub splines and splines on transmission main drive pinion should be a snug fit without signs of excessive wear. Metallic portions of disc assembly should be dry and clean and show no evidence of having been hot. Each of the arched springs between facings should be unbroken and all rivets should be tight.

(7) Wipe friction surface of pressure plate with kerosene, mineral spirits, or other suitable solvent.

(8) Using a straightedge, check pressure plate for flatness. The pressure plate friction area should be flat within .020 inch (.508 mm) and free from discoloration, burned areas, cracks, grooves, or ridges.

(9) Inner ends of release levers should have a uniform wear pattern.

(10) Using a surface plate, test cover for flatness. All sections around attaching bolt holes should be in contact with surface plate within .015 inch (.381 mm).

(11) The cover should be a snug fit on pressure plate lugs. If cover assembly does not meet these requirements, it should be replaced.



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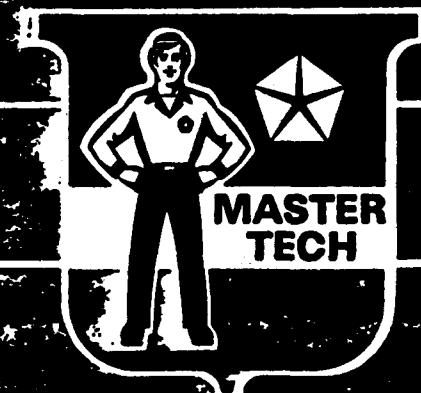
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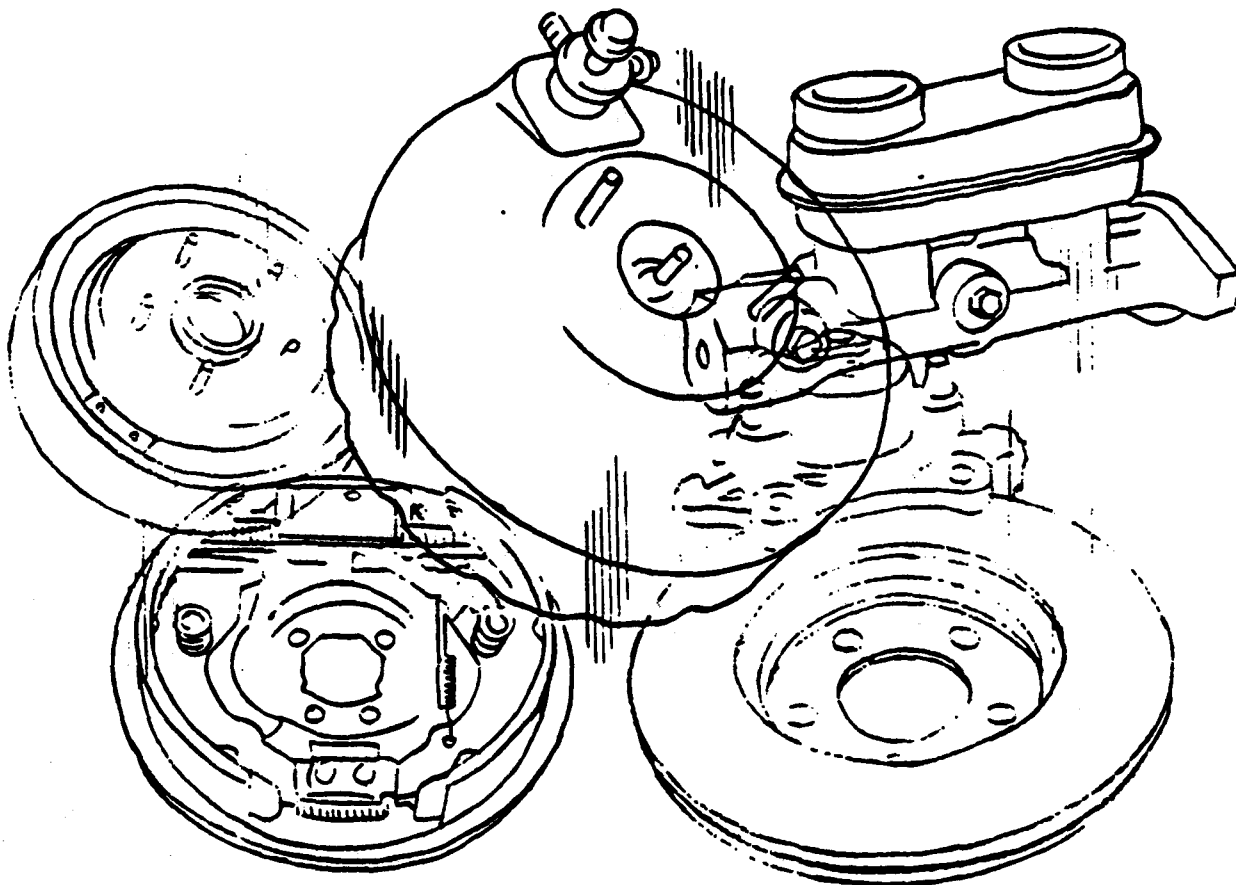
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MasterTech

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FRONT-WHEEL-DRIVE DOMESTIC BRAKE SYSTEM OPERATION AND DIAGNOSIS





Automobile performance is no longer just straight-line brute power. It is a vehicle's ability to instantaneously respond to a driver's needs. Chrysler's commitment to total balanced performance has been reflected in surefooted handling, smooth ride, and precise braking.

In this month's Master Tech session, we will discuss the operation and diagnosis of brake systems on Chrysler's domestically built front-wheel-drive vehicles.



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Standard Brake Equipment

Standard brake equipment on these vehicles consists of:

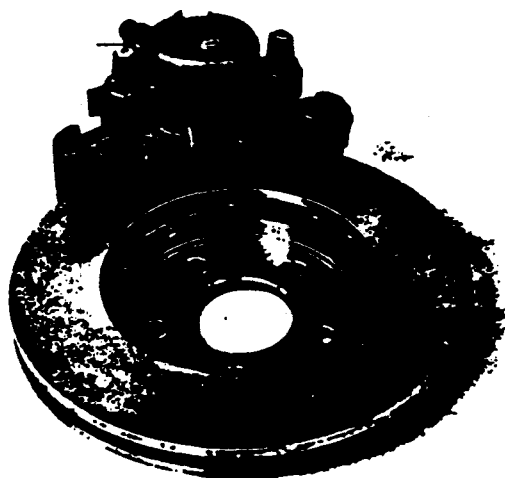


Fig. 1 — • Pin slider caliper front disc brakes.



Fig. 3 — • Brake booster.

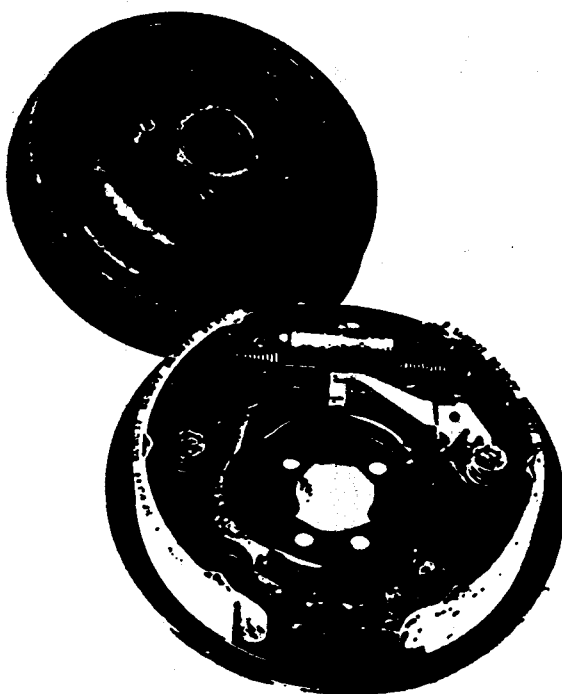


Fig. 2 — • Rear self-adjusting drum brakes.

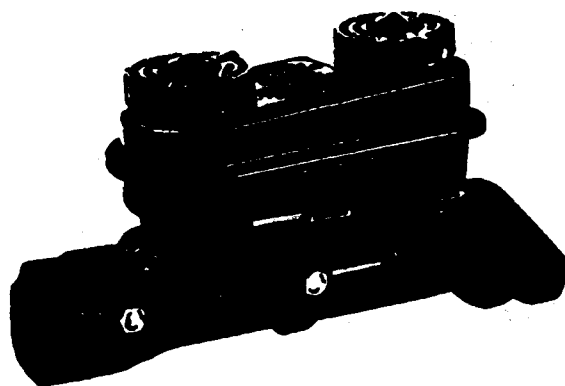


Fig. 4 — • Master cylinder.

There is a differential/proportioning combination valve on all models except the Chrysler New Yorker, Dodge 600 four door, and Plymouth Caravelle four door. Because of their balanced brake system, these models require a differential valve only.

All Chrysler brake systems are power assisted, using an aluminum dual master cylinder with a black nylon reservoir. 360-34-1135 The brake system is diagonally split, with the left front and right rear brakes on one hydraulic sys-

tem and the right front and left rear on the other (Fig. 5). This keeps the car's stopping power the same on both hydraulic circuits.

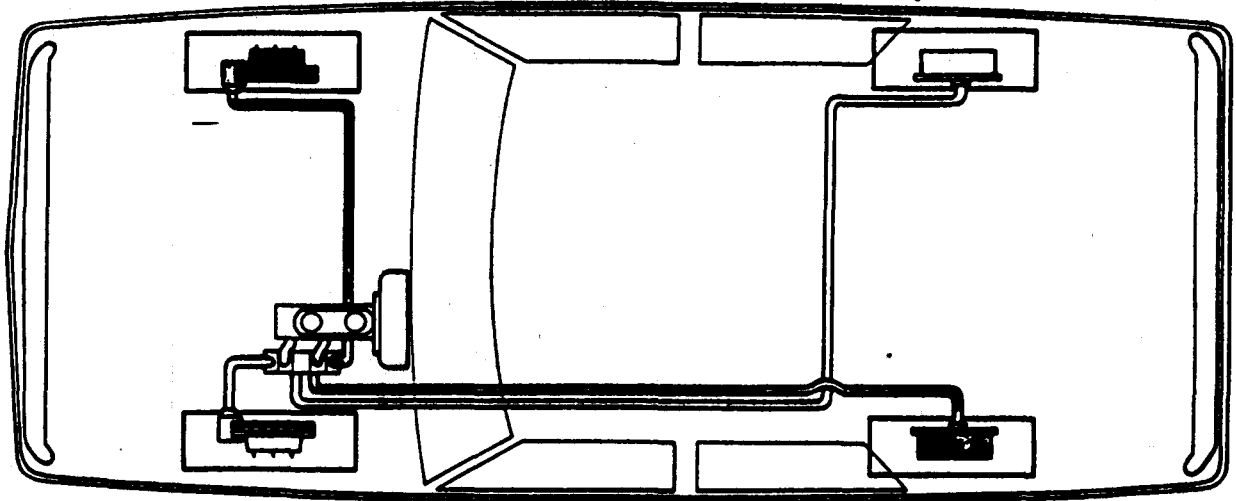


Fig. 5 — Chrysler's diagonally split brake system.

The Proportioning Valve

The proportioning valve distributes the correct amount of hydraulic pressure to the rear brakes (Fig. 6).

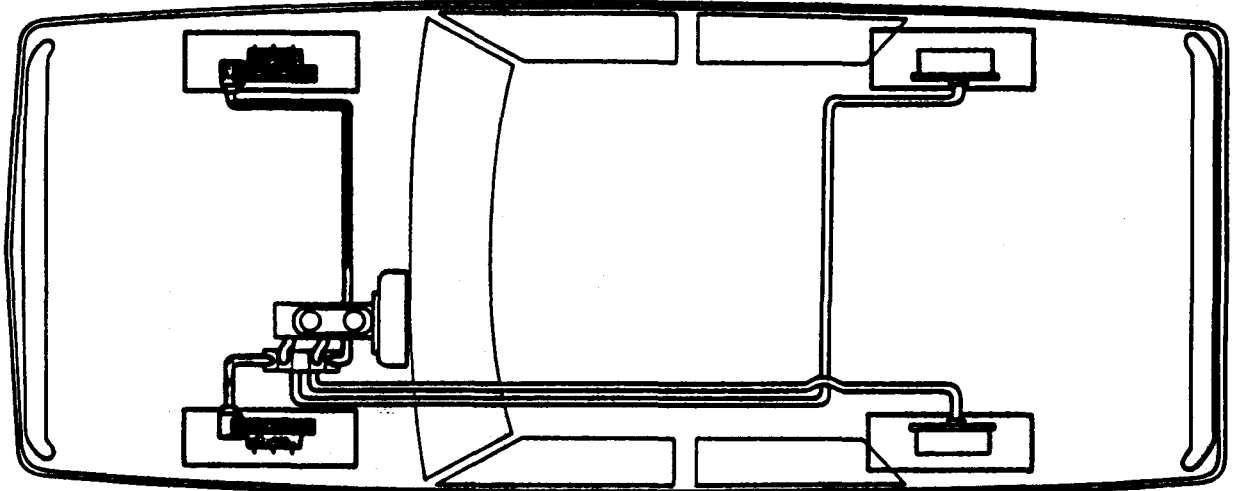


Fig. 6 — The proportioning valve keeps braking power under control.

The proportioning valve section operates by transmitting full input pressure to the rear brakes up to a certain point, called the split point (Fig. 7). And beyond that point, it limits the amount of hydraulic pressure increase to the rear brakes according to a certain ratio. Thus, on light pedal applications, approximately equal brake pressure will be transmitted to the front and rear brakes, while on

heavier applications, the pressure transmitted to the rear brakes will be lower than the pressure transmitted to the front brakes to prevent premature rear wheel lockup. If hydraulic pressure is lost in one half of the diagonally split system, the operation of the proportioning valve in the remaining half is not affected.

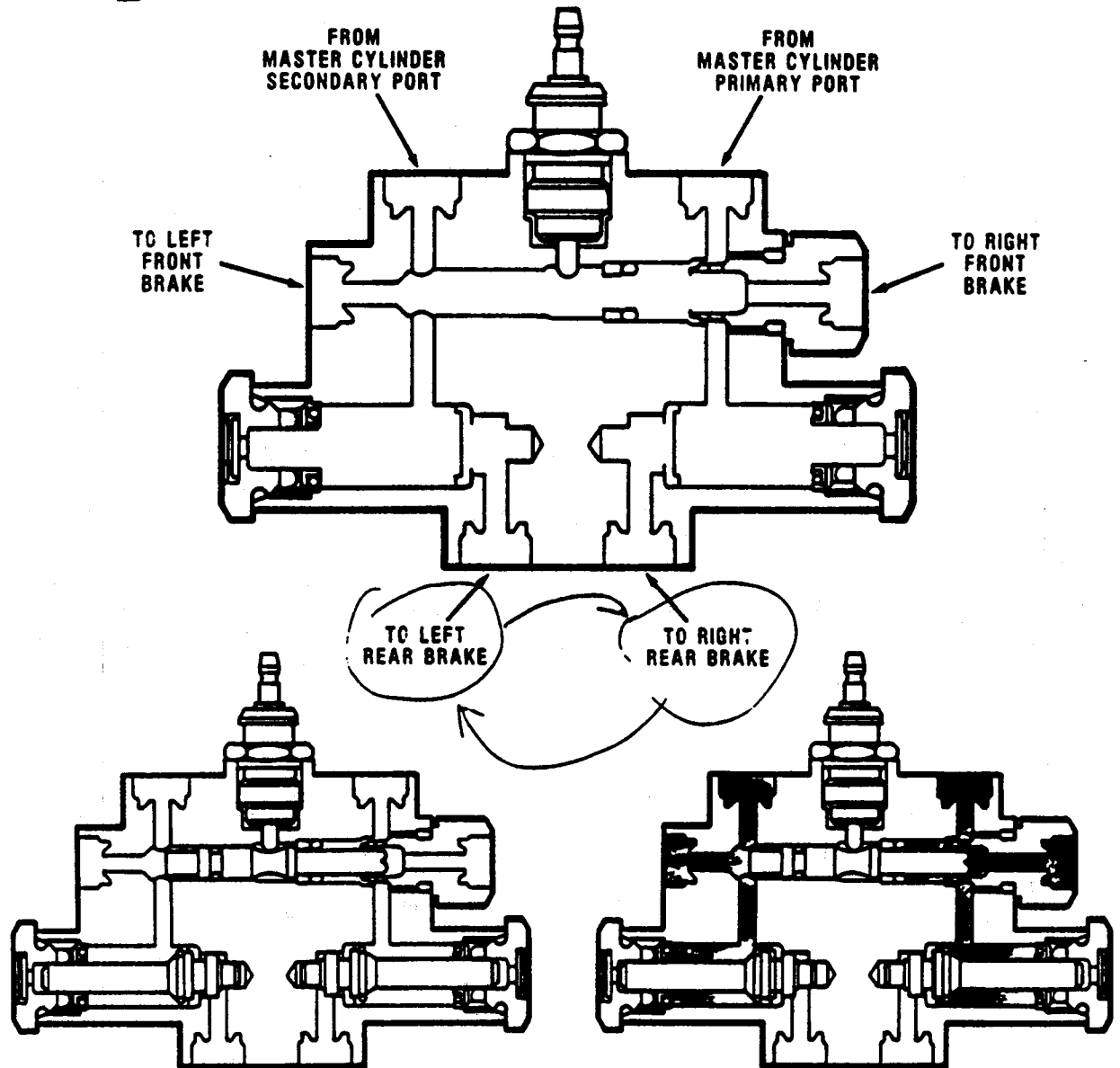


Fig. 7 — The proportioning valve's split point helps eliminate rear wheel lockup.

Despite the record of Chrysler's brake systems for reliability, occasionally problems may be encountered and dealing with these problems in the most time-efficient manner is in everyone's best interest.

If, for example, you receive a customer complaint of a "left rear wheel lockup" (Fig. 8), verify the complaint with a road test of the vehicle. Once you confirm the problem, you should refer to the service manual section on basic brake diagnosis (Fig. 9).

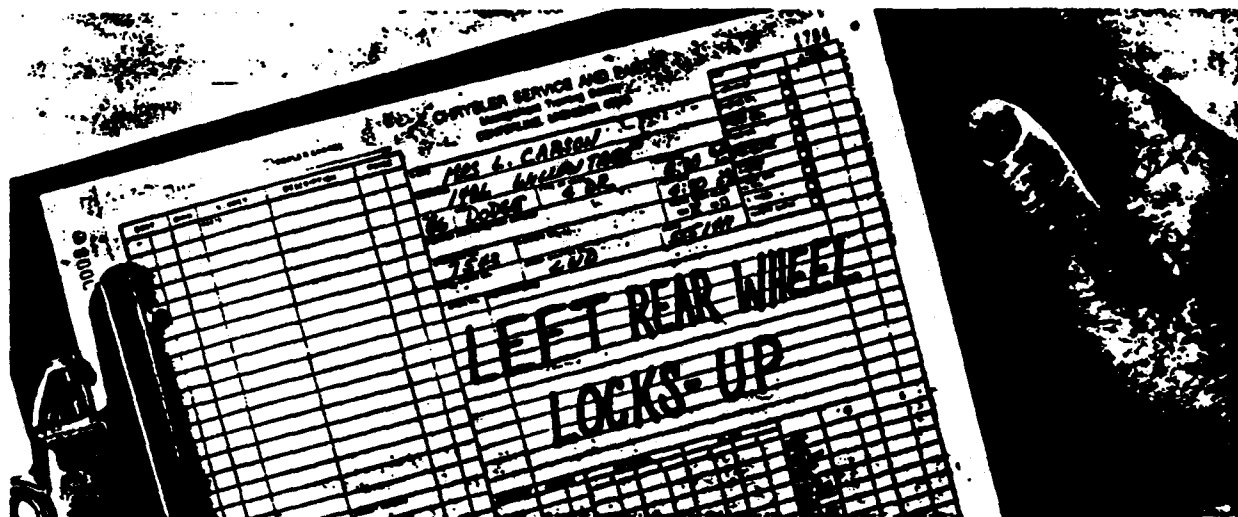


Fig. 8 — Rear wheel lockup can create a very dangerous braking condition.

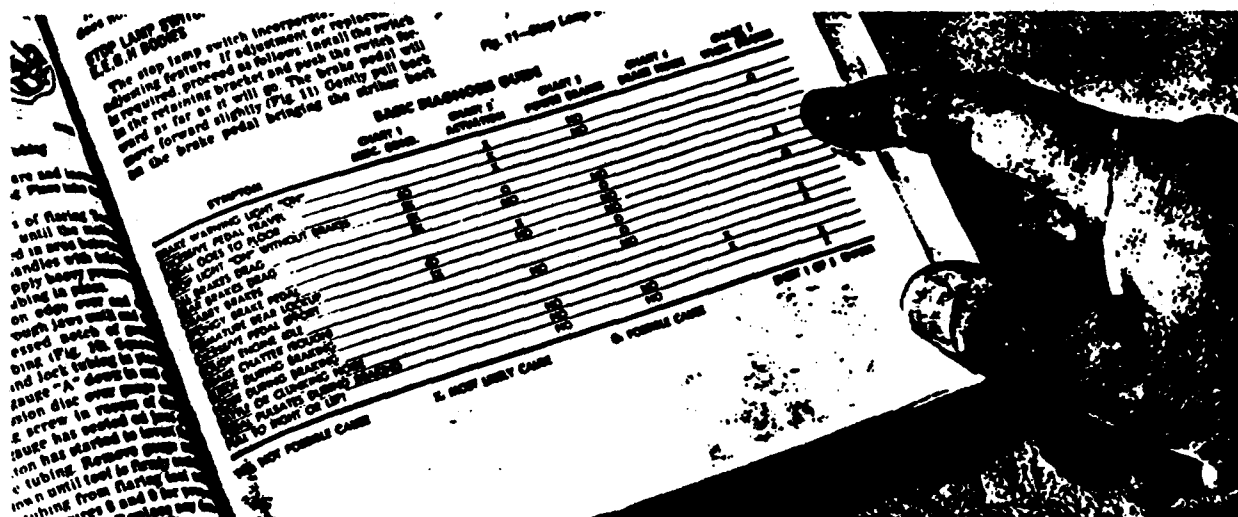


Fig. 9 — The various headings in the brake diagnosis section will help pinpoint the problem.

The service manual is a valuable tool for isolating a brake problem prior to replacing any brake component. By removing the wheel and brake drum, you can inspect the brake linings for wear, brake fluid contamination, or other types of contamination (Fig. 10). You can also inspect the wheel cylinder boots to make sure they are dry and work-

ing properly (Fig. 11). A fluid stain may be visible on the boot. 062-48-4960 This may not be a leak; it may be fluid used during assembly. If both check out, this indicates the proportioning valve may not be limiting hydraulic pressure to the left rear brake.



Fig. 10 — Always wear a mask while performing brake lining inspections.



Fig. 11 — Thoroughly examine the wheel cylinder.

Testing the Proportioning Valve

In order to test the proportioning valve when the left rear wheel locks first, install one gauge and "T" (set C-4007-A) between the brake line from the master cylinder primary port and the brake valve assembly (Fig. 12). Then

install the second gauge (set C-4007-A) to the left rear brake line, where it attaches to the left rear brake cylinder (Fig. 13).



Fig. 12 — Install a gauge and "T" to get a proportioning valve input reading.



Fig. 13 — The brake line from the rear wheel cylinder will give you an output reading.

Be sure to bleed the hose and gauge to get an accurate pressure reading (Fig. 14). Have a helper exert pressure on the brake pedal and hold it. Get a reading on the valve inlet gauge, then check the reading on the outlet gauge (Fig. 15).

If the inlet and outlet pressures do not agree with the values listed on the chart in the service manual (Fig. 16), replace the valve.



Fig. 14 — Air in the hose and gauge could affect the reading you receive.

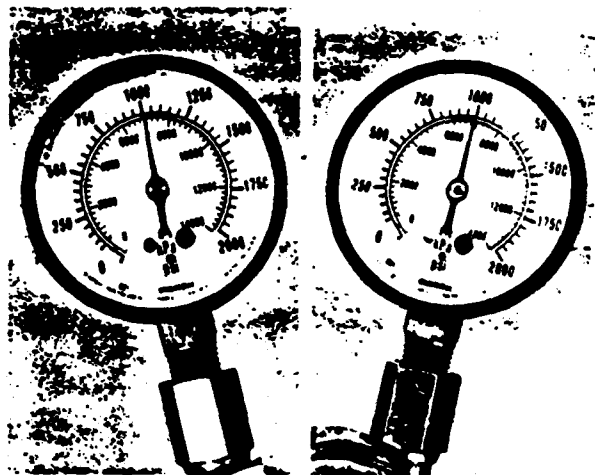


Fig. 15 — The same reading at the inlet and outlet would indicate that the proportioning valve is not performing its function.

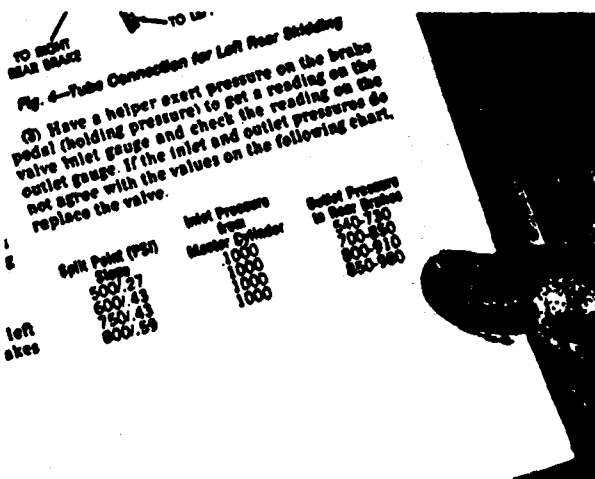


Fig. 16 — The chart in the service manual can help you confirm any problem related to the proportioning valve.



Master Cylinder Diagnosis

If the customer's complaint happens to be the "pedal goes to the floor," check for leaks or air in the system. If there are no leaks or air in the system, the master cylinder is the component to check. Incidentally, a brake booster will not be responsible for the pedal going to the floor.

Correct master cylinder diagnostic procedures can save time, trouble, and the unnecessary replacement of a properly functioning master cylinder.

When testing the master cylinder, always make sure the ignition switch is turned on so that the warning light system is operational (Fig. 17). Also test the brake warning light to verify that it is functioning properly (Fig. 18).



Fig. 17 — Master cylinder diagnosis is conducted with the ignition switch on.

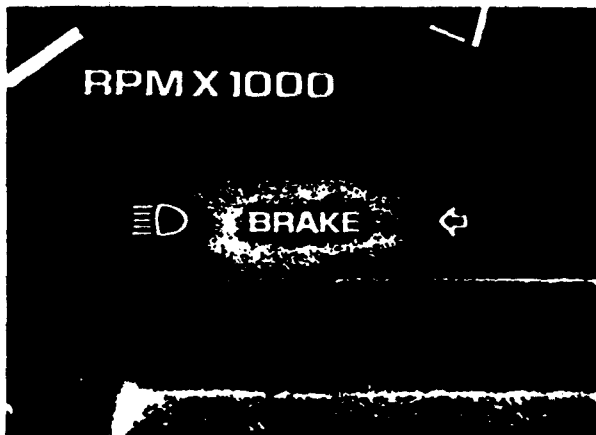


Fig. 18 — Is the brake warning light working?

Releasing the parking brake will verify whether or not the brake warning light is operating properly.

Before testing the hydraulic system, first check the brake fluid level and also check the underside of each reservoir cap to make sure the cap diaphragm is not swollen (Fig. 19). This may indicate fluid contamination.

The basic hydraulic test is conducted, with the ignition switch in the "on" position, by slowly applying the brake pedal and gradually increasing the pedal effort. If the



Fig. 19 — A swollen cap diaphragm is one of the signs of a contaminated brake system.

warning light turns on during moderate pedal effort and stays on when the pedal is released, and there is also no indication of a fluid leak, then the master cylinder has an internal leak and should be replaced.

However, if the warning light turns on after holding heavy pedal pressure for several seconds and stays on when the pedal is released, look for an external leak in the system (Fig. 20).



Fig. 20 — Check for external master cylinder leaks.



Brake Booster Diagnosis

If the customer's complaint is "high pedal effort," the cause could be the brake booster. Brake booster operation is an important element of the brake system's actuation. Diagnosis of any potential problem is outlined in the service manual and should be followed closely. 419-80-3517 However, before beginning diagnosis of the brake system, make sure the engine is providing enough vacuum — vacuum hoses are connected and not plugged or damaged. Remember to pay special attention to the vacuum line connection at the booster.

Begin the brake booster diagnostic test with the engine off. First depress and release the brake pedal several times to remove the vacuum from the power unit. Then depress and hold the pedal with light pressure and start the engine. If the power unit is operating properly, the pedal will fall slightly and then hold (Fig. 21). There will be less effort needed to depress the pedal. Remember, valid reasons for replacing a power brake booster are no booster assist, which is caused by an internal problem in the booster, and leakage in the booster, which can be identified by a hissing noise when light pressure is applied to the brake pedal.



Fig. 21 — Does the pedal fall slightly when you start the engine?

As we mentioned earlier, conditions such as excessive brake pedal travel and a spongy brake pedal are not causes for replacement of the brake booster. These conditions can often be corrected by simply bleeding the brake system.

Before you begin to use the bleeder tank with an adapter to pressurize the system for bleeding, first wipe the master cylinder cover clean to prevent dirt and other foreign matter from dropping into the master cylinder (Fig. 22). Then by following the manufacturer's instructions for the bleeder tools (Fig. 23), connect the pressure bleeder.



Fig. 22 — Always wipe the master cylinder cover clean before removing the caps.

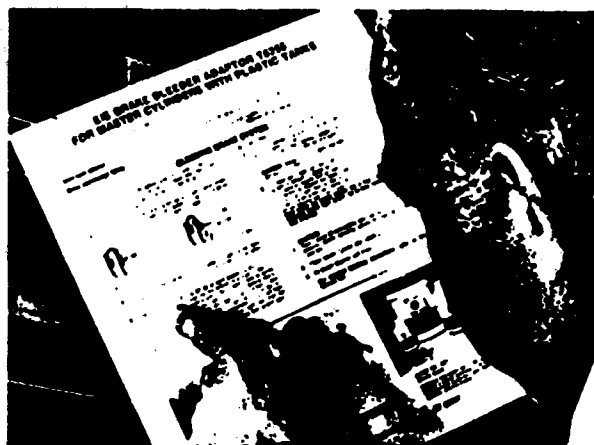


Fig. 23 — Follow the step-by-step instructions for using the pressure bleeder.

To bleed the brake system, attach a hose to the bleeder screw at one wheel cylinder or the caliper and feed the hose into a clear jar containing fresh brake fluid. Next, open the bleeder screw enough to allow a good volume of fluid to flow (Fig. 24). After a sufficient volume of fluid has been forced through the brake system, an "air-free flow" in the hose and jar will indicate a good bleed.



Fig. 24 — Be sure you open the bleeder screw wide enough.

If a pressure bleeder is not available for your use, a good fluid flow can be obtained by the conventional method of pumping the brake pedal three or four times, then pushing the pedal and holding it down while the bleeder screw is opened. Next, close the bleeder screw and release the pedal. Repeat these steps four or five times at each bleeder screw to pass a sufficient amount of fluid to expel all the trapped air in the brake system. Remember to refill the fluid in the reservoir, after bleeding each wheel.

Test driving the vehicle will help you verify that the situation has been corrected and that the brakes are working properly.

Regardless of what method of bleeding the brakes you employ, only use manufacturer's recommended Dot 3 brake fluid that's been stored in a sealed container (Fig. 25). A container that hasn't been thoroughly sealed could be contaminated by moisture. 171-58-7563 Any condensation in the brake fluid could lower the boiling point from a normal 450 degrees Fahrenheit to below 250 degrees Fahrenheit and possibly cause a partial loss of braking. Condensation in the brake fluid could also lead to internal corrosion of metal brake components, and premature wear and deterioration of rubber brake components.



Fig. 25 — Only use Dot 3 brake fluid.

Other forms of brake system contamination would be petroleum-based products such as power steering fluid and automatic transmission fluid used instead of brake fluid. These forms of contamination can be detected by discolored brake fluid and swollen seals. To illustrate how a rubber brake component can swell when exposed to a petroleum-based liquid, we filled a master cylinder with transmission fluid and allowed it to soak overnight. And the result was a very swollen cap diaphragm (Fig. 26).

If faced with a condition of brake fluid contamination:

- Flush the system with fresh brake fluid.
- Replace the proportioning valve.
- Replace the master cylinder.
- Replace all rubber components including hoses.
- Replace all internal seals in the calipers and wheel cylinders.

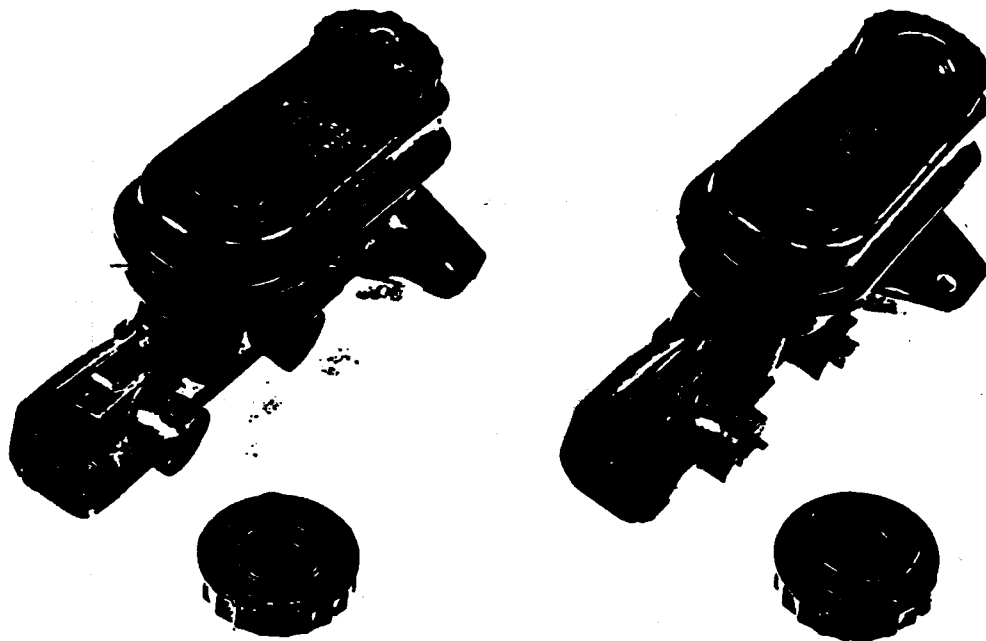
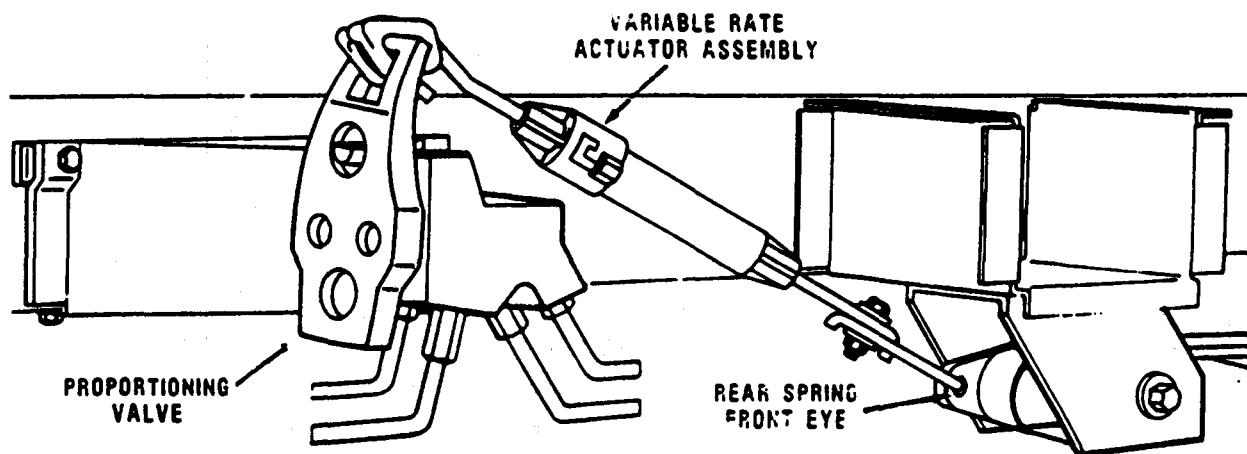


Fig. 26 — Compare the two cap diaphragms:
Left master cylinder filled with brake fluid. Right master cylinder filled with transmission fluid.

Height-Sensing Proportioning Valve



Height-sensing proportioning valve location and components.

The 1986 Dodge Caravan, Plymouth Voyager, and Dodge Mini Ram Van have a height-sensing proportioning valve as part of their brake systems. These systems modulate the amount of rear braking force in relation to the amount of cargo load over the vehicle's rear axle. This modulation minimizes the possibility of rear wheel lockup during stops under light load conditions (Fig. 27), while maintaining effective rear braking as loads increase (Fig. 28). Proper adjustment of the height-sensing proportioning valve is a very important element of safe and predictable braking.

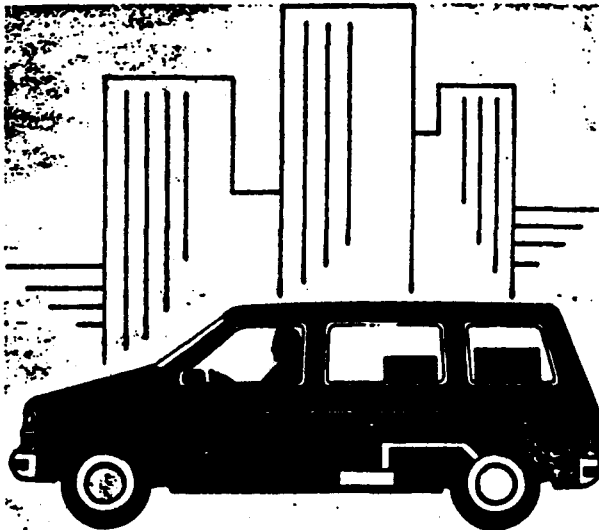


Fig. 27 — The height-sensing proportioning valve.



Fig. 28 — The height-sensing proportioning valve adjusts to heavy loads.

To facilitate adjustment, lift the vehicle with a frame contact hoist or other means so that the rear suspension hanging free. 124-50-4146 Then temporarily support the rear suspension and disconnect the shock absorbers from the axle (Fig. 29). Also remove both rear wheels. Be sure that the rear springs do not contact the hoist or an improper adjustment may result (Fig. 30).



Fig. 29 — Disconnect the shock absorbers.



Fig. 30 — Check your clearance between the springs and hoist.

Using an eight millimeter wrench, loosen the adjustment nut on the proportioning valve actuator assembly (Fig. 31). 438-35-2992 Prior to adjustment, make sure that the actuator assembly hook is properly seated on the valve lever. (Fig. 32).



Fig. 31 — Loosen the adjustment nut.

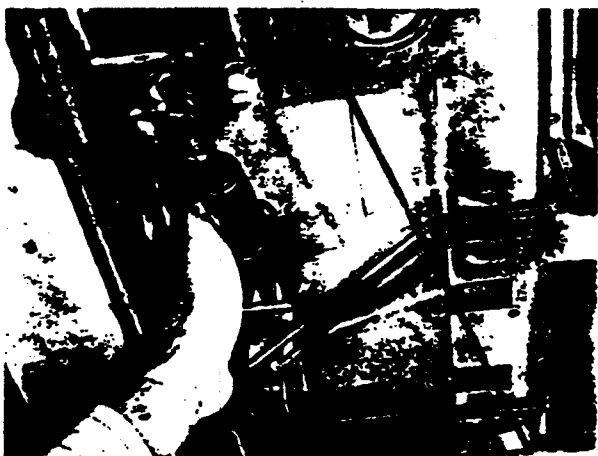


Fig. 32 — Check that the actuator hook is in place on the valve lever.

If the customer complaint you received was "early rear wheel skid" or "poor rear brake lining life," you may discover that the proportioning valve adjuster unit is improperly set.

A complaint of "high pedal effort" or "poor front brake lining life" may also indicate that the adjuster unit is improperly set.

To properly adjust the unit, pull the actuator assembly toward the spring hanger until the valve lever bottoms on the valve body. Hold it in this position (Fig. 33). After tight-

ening the adjustment nut to 45 inch-pounds and completing the procedure (Fig. 34), install the wheels. Then temporarily support the rear suspension again to connect the shock absorbers. Finally, road test the vehicle to make sure the problem has been corrected.



Fig. 33 — Firmly hold the actuator assembly in place during adjustment.



Fig. 34 — Tighten the adjuster to the specified 45 inch-pounds.

A word of caution — no aftermarket load-leveling systems or helper springs should ever be added to the Caravan, Voyager, or Mini Ram Van models. This could alter the proportioning valve setting and drastically affect brake performance.

SUMMARY

Brake systems are obviously crucial systems on all automobiles. By following the recommended procedures that have been outlined in this session, you will discover that you can put a stop to time-consuming brake repairs.

THE SERVICE PROFESSIONALS



QUIZ

INSTRUCTIONS: Questions one through ten are multiple-choice questions. Circle the letter in front of the answer you think is correct. For example, if your choice in number one is C, put a circle around it like this **C**. Be sure to write your name in the space provided. After completing the quiz, turn it in to your meeting leader.

NOTE: DO NOT TEAR OFF THIS PAGE

1. If you receive a customer complaint that the "pedal goes to the floor," the problem will not be:
 - A. the brake booster.
 - B. air in the system.
 - C. the master cylinder.
 - D. B and C.
2. Contamination in the brake system from a petroleum-based product can be detected by:
 - A. discolored brake fluid.
 - B. swollen seals.
 - C. corrosion of metal brake components.
 - D. A and B.
3. After adjusting the height-sensing proportioning valve, tighten the adjuster nut to:
 - A. 35 inch-pounds.
 - B. 15 inch-pounds.
 - C. 45 inch-pounds.
4. Begin the brake booster diagnostic test:
 - A. by starting the engine.
 - B. with the engine off.
 - C. by depressing the parking brake.
5. On light pedal applications, the proportioning valve will transmit:
 - A. lower pressure to the front brakes.
 - B. equal brake pressure to the front and rear brakes.
 - C. higher pressure to the front brakes.
6. Valid reasons for replacing a power brake booster are:
 - A. no booster assist.
 - B. the pedal goes to the floor.
 - C. leakage in the booster.
 - D. A and C.
 - E. none of the above.
7. Before you begin to use the bleeder tank with an adapter to pressurize the system for bleeding:
 - A. pump the brake pedal four or five times.
 - B. wipe the master cylinder cover clean.
 - C. check all vacuum hoses.
8. If the proportioning valve inlet and outlet pressures do not agree with the values listed on the chart in the service manual:
 - A. replace the valve.
 - B. check the brake booster.
 - C. flush and bleed the brake system.
9. The Chrysler New Yorker, Dodge 600 four door, and _____ require a differential valve only.
 - A. Dodge Daytona
 - B. Chrysler LeBaron
 - C. Plymouth Caravelle four door
10. Technician A says that if the warning light turns on during moderate pedal effort and stays on when the pedal is released, and there is no fluid leak, the master cylinder should be replaced. Technician B says that the brake booster should be replaced.

Who is right?

 - A. Technician A.
 - B. Technician B.
 - C. Neither technician.



NAME _____

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**THE
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Printed in U.S.A.

JANUARY

MASTER TECH 88

1988
NEW YORKER AND DYNASTY
ANTILOCK BRAKE SYSTEM



 **CHRYSLER
MOTORS**
SERVICE & PARTS
OPERATIONS

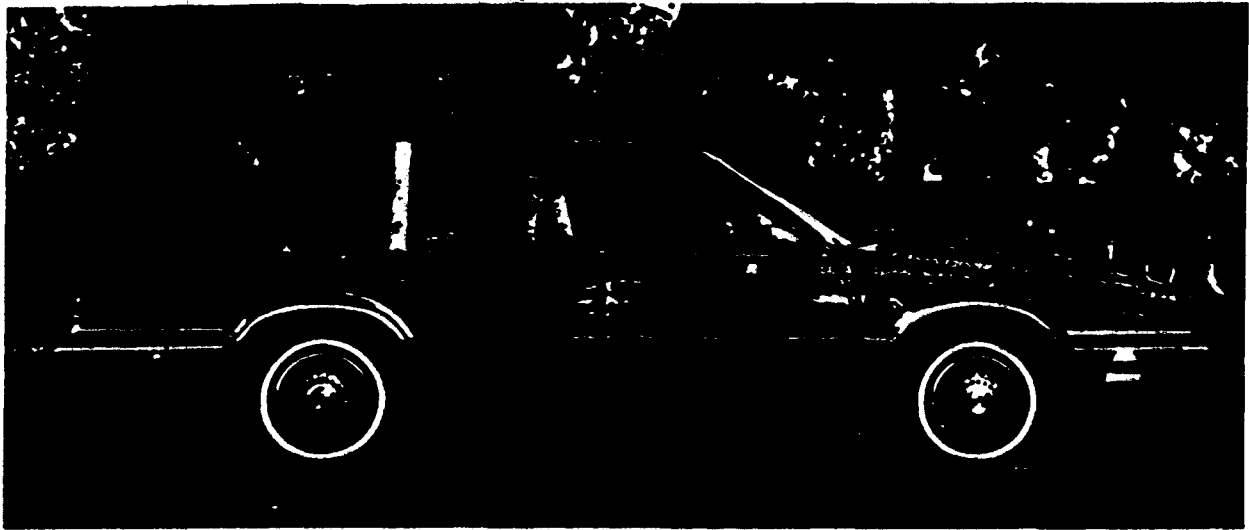


Fig. 1 — The 1988 Chrysler New Yorker Landau.

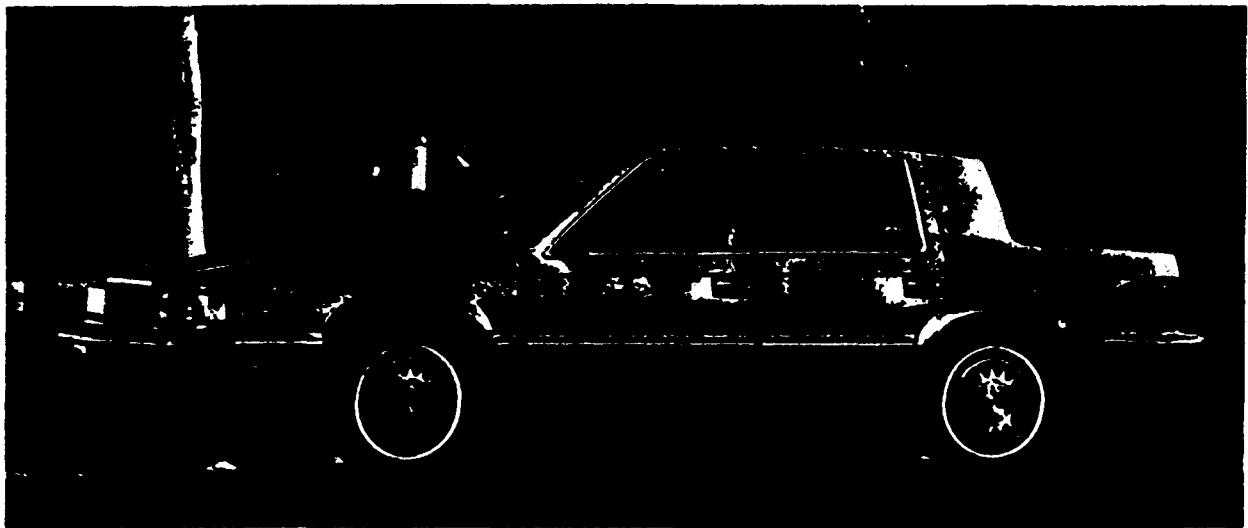
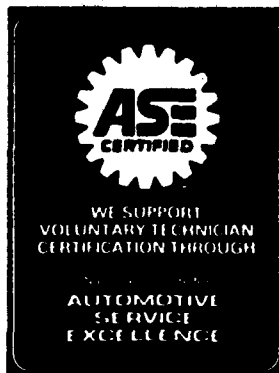


Fig. 2 — The 1988 Dodge Dynasty LE.



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The 1988 Chrysler C-Body New Yorker and Dodge Dynasty (Figures 1, 2) offer luxury and convenience features that rival the competition.

Going one step further, a new electronically controlled four-wheel antilock disc brake system has been made available as an option on the Chrysler New Yorker, New Yorker Landau, and Dodge Dynasty LE models.

This system helps maintain vehicle stability during

braking on dry, wet or slippery surfaces.

By preventing the brakes from locking, it also allows the driver to maneuver the vehicle during extreme stopping conditions.

In this month's Reference Book, you will read about the operation, components and diagnostic procedures surrounding this amazing system.

The antilock system prevents brake lockup by modulating the brakes many times per second whenever antilock action is required (Figure 3).

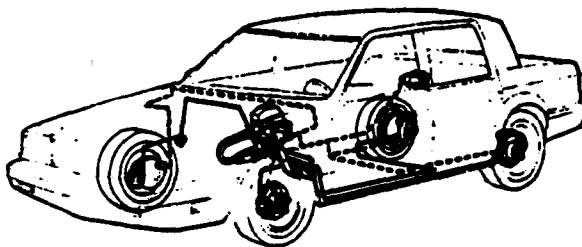


Fig. 3 — Antilock brakes prevent lockup by computer-controlled modulating action.

To determine when antilock is required, the antilock brake control module (ABCM) senses the speed of each wheel using "toothed" discs, known as tone wheels and wheel-speed sensors.

At the front, the tone wheels are attached to the drive axle outboard CV joints. At the rear, they are attached to the brake hubs.

A sensor is positioned close to each tone wheel. It detects wheel speed as magnetic pulses whose frequency matches the speed of the wheel.

The antilock brake control module monitors the rate of change of the pulse frequency to calculate deceleration.

If one wheel slows down too quickly, the ABCM determines that the wheel is beginning to lock and reduces hydraulic pressure to the corresponding brake.

When the wheel starts to accelerate, pressure is increased again and the cycle repeats until driver demand for braking is reduced below that requiring antilock action or until the car has slowed to approximately two to three miles per hour (Figure 4). Below two to three miles per hour, the system shuts off and returns to normal brake operation.

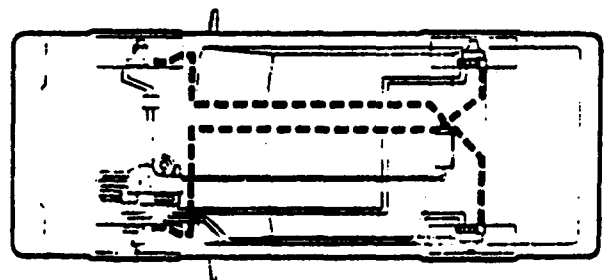


Fig. 4 — Schematic operation of antilock brakes.

During normal stops, such as a moderate stop on dry pavement, the braking system functions in the same manner as conventional brakes.

The New Yorker and Dodge Dynasty vehicles equipped with antilock brakes do not use a vacuum booster.

Instead, an electric motor-driven hydraulic pump, an accumulator (pressure reservoir), and hydraulic assembly work together to reduce pedal effort required to stop the vehicle (Figure 5).

The pump runs intermittently to maintain hydraulic pressure in the accumulator for power assist and anti-lock braking. The electric pump and accumulator serve as a fail-safe system by providing hydraulic pressure even if the engine stalls.

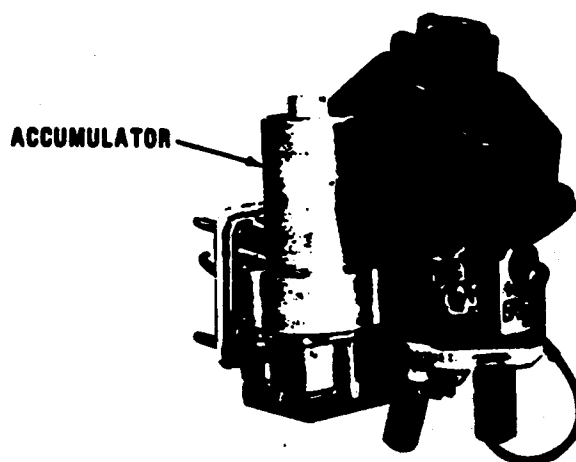
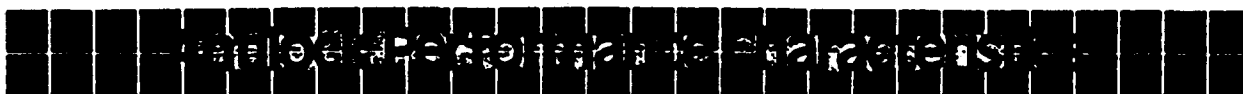


Fig. 5 — The antilock system's hydraulic assembly.



The ABS represents a vehicle braking system that offers the driver increased safety and control during hard braking. This is accomplished by a combination of electrical and hydraulic components that differ from conventional vacuum-assisted brake systems. As a result, there are several performance characteristics that may, at first, seem different from those normally experienced with a simple vacuum-assisted system. Mentioned below are some of those differences that are perfectly normal with ABS.

ABS utilizes hydraulic power assist for normal braking and provides a source of high-pressure hydraulic fluid during antilock braking. An advantage of this system is to reduce total pedal travel during normal braking, resulting in a firm short-travel pedal feel.

When the vehicle is not in motion, pedal feel will seem springy and pedal travel may seem excessive, which is normal (Figure 6). In general, the pedal will feel different from that of a conventional brake system.

Because of hydraulic power assist, it is not possible to diagnose brake system problems by judging brake pedal feel. The master cylinder is isolated from the brake pedal by the booster servo circuit. Conditions such as air in the system or a generally low pedal will not be experi-



Fig. 6 — When not in motion, the brake pedal travel may seem excessive.

enced when the system is under hydraulic assist.

Also, during antilock braking, brake pressures are modulated by cycling electric valves. This cycling can be heard as a series of popping or ticking noises. In addition, this cycling may be felt in the brake pedal as a pulsation. During hard antilock operation, some pulsation may be felt in the vehicle body. This is caused by pressures being modulated.

A wheel-speed sensor is located at each wheel (Figure 7) and transmits wheel-speed information to the ABCM by generating a small amount of AC voltage.

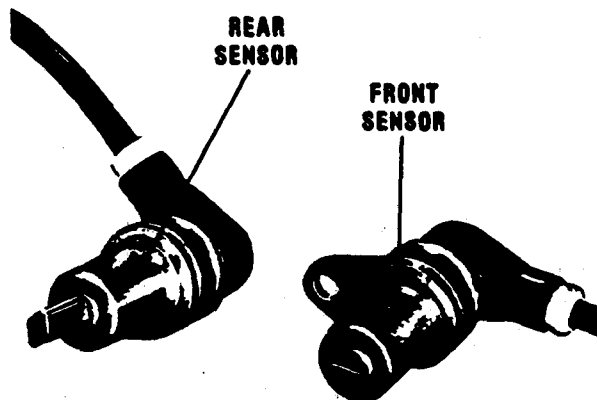


Fig. 7 — There are two types of wheel-speed sensors.

This voltage is induced by rotating a toothed ring, known as a tone wheel, past a stationary magnetic sensor or wheel-speed sensor.

The sensor is attached to a boss in the steering knuckle, and the tone wheel is part of the outboard constant velocity joint for the front wheels. For the rear wheels (Figure 8), the sensor is mounted to the caliper adapter. The tone wheel is an integral part of the wheel hub.

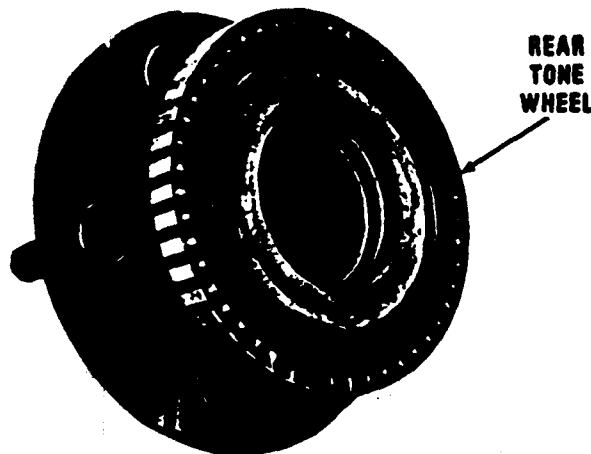


Fig. 8 — The tone wheel detects individual wheel speed.

The antilock brake control module (Figure 9) is a small computer located in the trunk. It monitors wheel-speed sensor signals as well as several internal functions of the antilock brake system's hydraulic assembly.

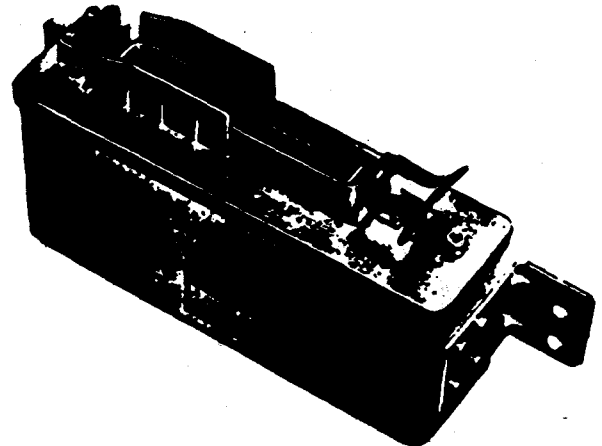


Fig. 9 — The antilock brake control module.

The primary function of the ABCM is to detect wheel-locking tendencies, control the brake system while in the antilock mode, monitor the system for proper operation, and control the display of the ABS fault codes while in the diagnostic mode.

The ABCM can determine when a wheel is accelerating or decelerating by the frequency of the voltage it reads from each wheel.

The ABCM continuously checks the speed of each wheel to determine if any wheels are beginning to lock. If a wheel-locking tendency is detected, the ABCM commands the appropriate wheel circuit valve to modulate brake fluid pressure in some or all of the hydraulic circuits to prevent wheel lockup. The ABCM continues to control pressure in each individual hydraulic circuit until a locking tendency is no longer present or when vehicle speed drops to two to three miles per hour or below. If the ABCM detects a malfunction, it can disable the antilock portion of the system, turn on the antilock warning lamp and/or the brake warning lamp (Figure 10).

In addition, the ABCM also has self-diagnostic capabilities. A total of 16 fault codes may be stored in the ABCM and displayed for diagnostic purposes.

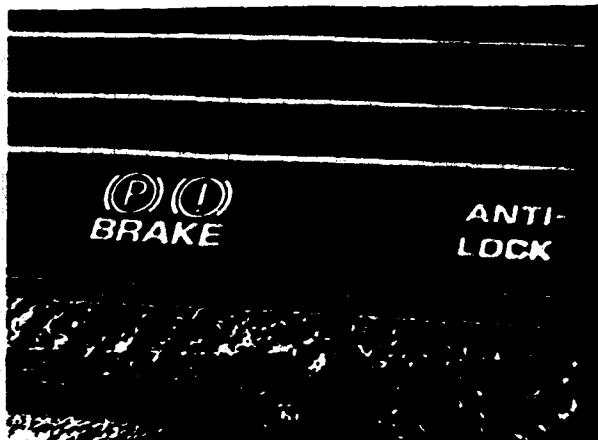


Fig. 10 — Warning lamps alert the driver of an antilock malfunction.

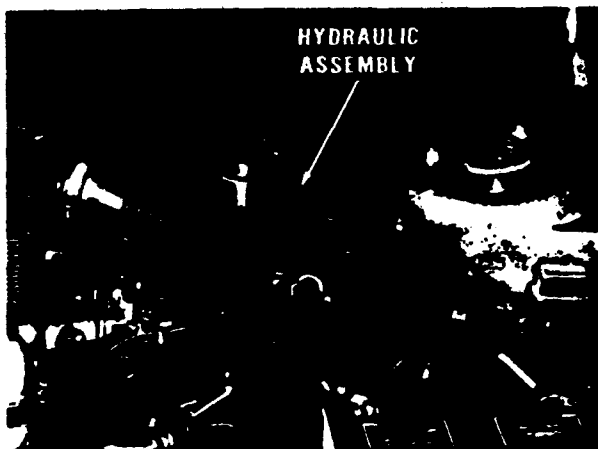


Fig. 11 — The antilock's hydraulic assembly is located in the same place as a conventional system.

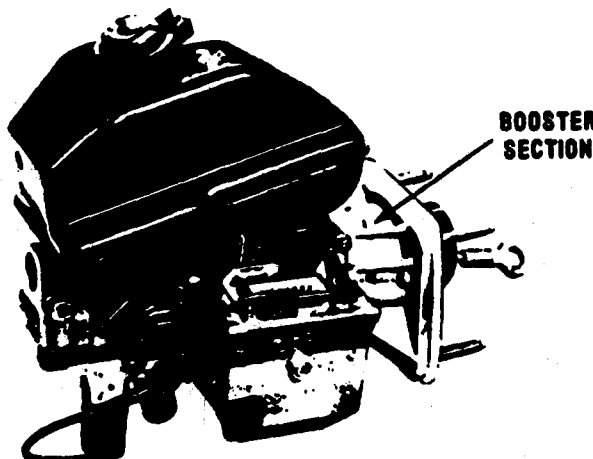


Fig. 12 — The antilock booster assembly.

The antilock brake system utilizes an integral hydraulic assembly located on the cowl panel (Figure 11).

This assembly provides the function of a booster and master cylinder. In addition, the hydraulic assembly provides brake pressure modulation for each of the individual wheel circuits as required during antilock braking.

The booster/master cylinder portion of the hydraulic assembly (Figure 12) is an integral component and should never be disassembled. This unit is serviced with the hydraulic assembly.

The master cylinder portion of the assembly uses a diagonally split configuration during normal braking. The two circuits are hydraulically isolated so that a leak or malfunction in one circuit will allow continued braking ability from the other.

A hydraulic accumulator (Figure 13) is used to store the brake fluid at a high pressure. This pressurized fluid is made available for antilock operation and for normal power-assisted braking.

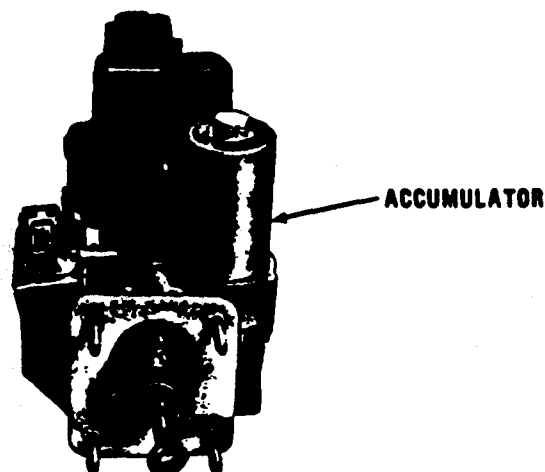


Fig. 13 — The accumulator's operating pressure is approximately 2,100 to 2,600 psi.

The accumulator uses a sliding piston configuration with a nitrogen pre-charge of approximately 800 psi. Under normal operation, the pump/motor assembly charges the accumulator to an operating pressure of approximately 2,100 to 2,600 psi.

For this reason, it is extremely important that the recommended precautions be followed when servicing the system to prevent personal injury and/or damage to painted surfaces.

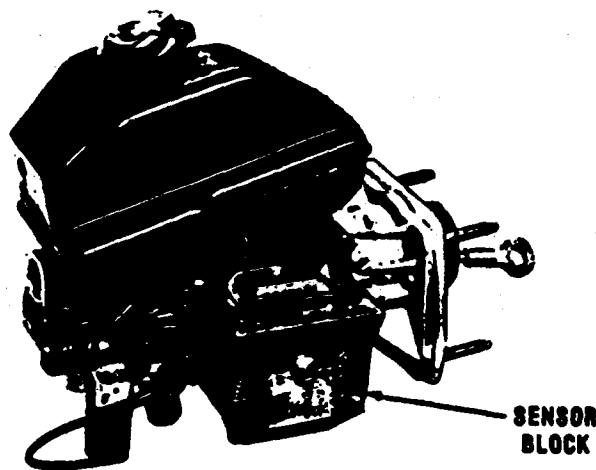


Fig. 14 — The sensor block location.

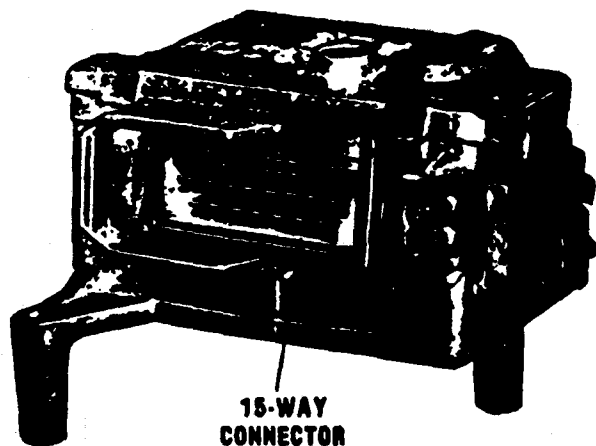


Fig. 15 — The sensor block provides electrical communication between the hydraulic assembly and all other ABS components.

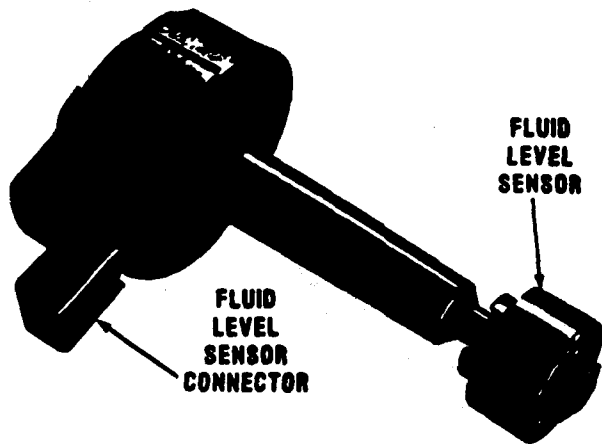


Fig. 16 — The fluid level sensor detects a low fluid condition.

Be sure to remember the hydraulic accumulator is a non-serviceable component. Removal or disassembly may result in personal injury and/or improper system operation. When servicing components of the hydraulic system, always depressurize the accumulator as we will describe later.

The sensor block is mounted on the left side of the hydraulic assembly and contains several electrical components (Figure 14).

All electrical communications between the hydraulic assembly and all external components, including the ABCM, take place through the sensor block 15-way connector (Figure 15). The sensor block is serviceable as an assembly. There is a fluid level sensor located in the hydraulic assembly reservoir cap (Figure 16).

This sensor consists of a float and magnetic reed switch that closes when low fluid is detected.

The fluid level sensor is used as an input to the brake warning lamp and ABCM. Upon detection of low fluid, the brake warning lamp will be illuminated and the antilock system disabled. The fluid level sensor can be serviced as an individual component.

Boost pressure, which is critical to system operation, is provided by an electrohydraulic pump (Figure 17), which takes brake fluid from the hydraulic assembly reservoir, pressurizes the fluid, and supplies it to the hydraulic accumulator. Electrical power is supplied to the pump motor through the pump motor relay located on the left inner fender shield.

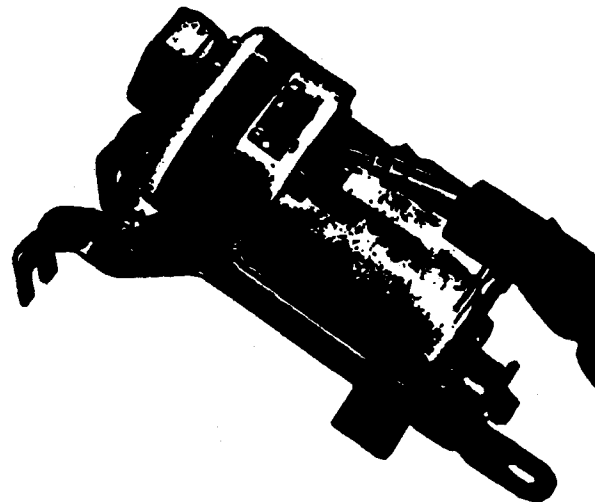


Fig. 17 — A hydraulic pump/motor assembly pressurizes the accumulator with brake fluid.

The ABS system is powered through an over voltage protection relay (OVPR) located on the left inner fender shield along with the pump/motor relay (Figure 18).

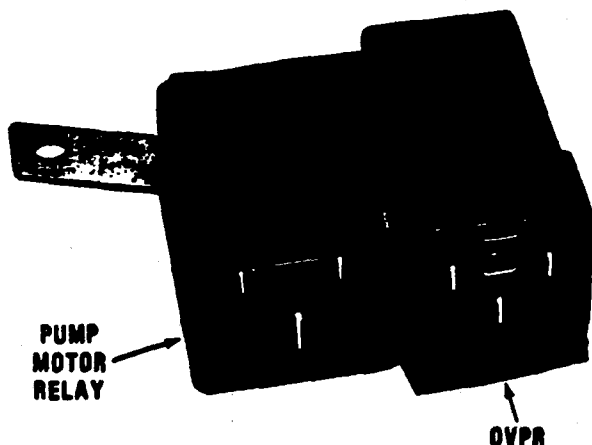


Fig. 18 — The pump motor and the ABS are powered through these two relays.

The OVPR is designed to prevent high-voltage spikes from reaching the ABCM and sensor block circuits. The OVPR also serves as a main system relay, providing power when the ignition is turned "ON."

On the antilock system, screw-in proportioning valves are utilized in place of the conventional differential pressure/proportioning valve (Figure 19).

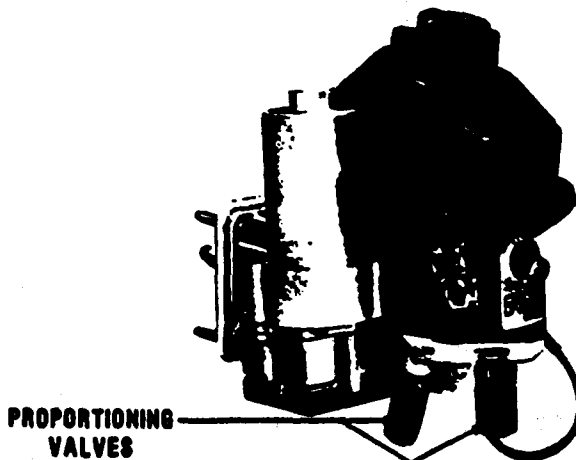


Fig. 19 — Screw-in proportioning valves are used in the antilock system.

Each rear brake circuit has its own proportioning valve, which is attached to the rear brake outlet ports of the hydraulic assembly.



There are two self-checks that the system performs every time the vehicle is started: First, when the key is turned on, the system performs an electrical check called power on reset (PORS).

During this check, the brake warning lamp and the antilock warning lamp are illuminated and then turned off at the end of the one to two second test (Fig. 20).

As soon as the vehicle is driven and reaches a speed of approximately three miles per hour, the system performs a functional test called BITE for built-in test equipment. During BITE, all hydraulic valves are activated briefly to test their function.

BITE can be detected as a series of clicking or popping noises upon driving off after an initial start-up. If the brakes are applied during BITE, some feedback will be noticed in the brake pedal and, as mentioned earlier, is considered normal. Customers complaining of this should be reassured that the system is operating properly.

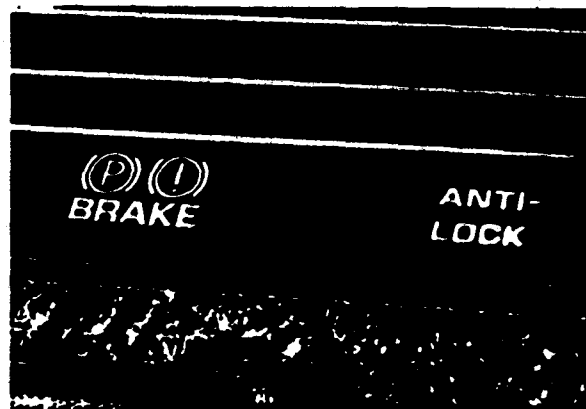


Fig. 20 — When first started, the illuminated brake and antilock lights indicate that two tests are being performed.

Also, fault codes can automatically be set by the ABCM when certain failures are encountered. These will aid in diagnosing system failures and will be discussed in detail in the upcoming "diagnostics" section.

There are two methods for notifying the driver of a system malfunction. They include the standard red brake warning lamp and an amber antilock warning lamp, both of which are located in the instrument cluster.

The red brake warning lamp will illuminate to warn the driver of conditions that may result in reduced braking ability. Conditions that may cause this lamp to illuminate are parking brake applied, low brake fluid, low accumulator pressure, failure in a diagonal brake circuit or in the brake hydraulic system, output for the system's diagnostic mode and brake warning lamp bulb check.

Remember: Continuous illumination of the red brake warning lamp may indicate reduced braking ability. Some conditions that turn the brake warning lamp on will also activate the amber antilock warning lamp, thus disabling the antilock capabilities of the system. If the brake warning lamp is illuminated, the vehicle should not be driven unless instructed by specific diagnostic procedures in the service manual.

Now, let's look at the yellow antilock warning light. This warning lamp will remain on until the ABCM completes its self-diagnostic check as previously described. If a condition is detected that results in a shutdown of the antilock function, the warning lamp is illuminated.

Also, display of the antilock warning lamp without the red brake warning lamp indicates that the antilock function has been disabled. However, normal power-assisted braking will not be affected.

If the vehicle has not been started for several hours, the brake warning lamp and the antilock warning lamp may both be illuminated for as long as 30 seconds after turning the ignition on or starting the vehicle. This condition is caused by normal leak-down in the hydraulic accumulator. When the ignition key is then turned "ON," the pump/motor must recharge the hydraulic accumulator to its normal operating pressure. During recharging, both warning lamps will remain on until the accumulator pressure reaches approximately 2,100 to 2,600 psi. Both lamps should remain "OFF" at all other times.



There are many conditions technicians can troubleshoot regarding the antilock system; for example: antilock warning lamp illumination, brake warning lamp illumination; or lack of power assist.

Diagnosis of conditions such as brake noise, brake pulsation, vehicle vibration during normal braking, brake pull, and parking brake problems is obviously of a mechanical nature and technicians should refer to the brake section of the service manual (Figure 21).

Many conditions that generate customer complaints may be normal operating characteristics of this system. These characteristics can be recognized without performing extensive diagnostic work, given an adequate understanding of the operating principles and performance characteristics of the system such as system self-tests and pedal feel. Thoroughly familiarize yourself with them before performing any diagnoses.

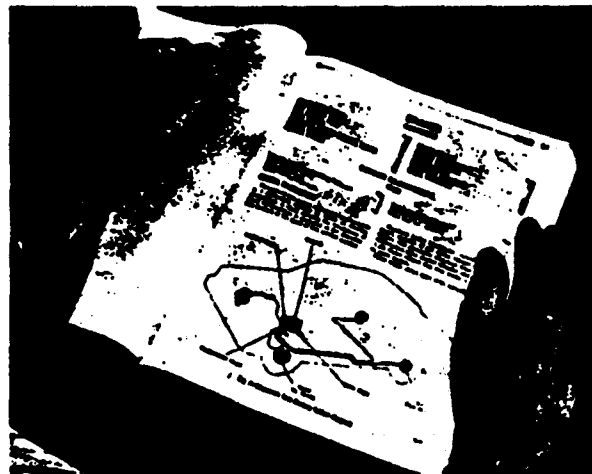


Fig. 21 — Answers to brake problems of a mechanical nature can be found in the brake section of the service manual.

The ABS system is equipped with a self-diagnostic capability that may be used to assist in isolating ABS faults. This feature includes 16 fault codes that may be displayed by the ABCM. This is accomplished by flashing the red brake warning lamp in the instrument panel.

Only one fault code can be stored at a time. Also, fault codes are not stored when the ignition is "OFF." Any codes that are generated are lost when the ignition is turned "OFF." To access these fault codes, it is necessary to enter the diagnostic mode. So let's go through the procedure:

First, the ignition must be "ON" to enter the diagnostic mode (Figure 22). Remember that fault codes are erased when the ignition is turned "OFF."



Fig. 22 — To enter the diagnostic mode, turn the ignition on.



Fig. 23 — Release the parking brake when entering the diagnostic mode.

Make sure that the parking brake is fully released (Figure 23).

Then check to see that a fault has been detected by checking for an illuminated brake warning lamp or the antilock warning lamp. If neither lamp is illuminated, verify the complaint by test driving the vehicle.

Once a fault is detected, without turning "OFF" the ignition, depress the brake pedal fully with firm pedal effort and hold (Figure 24). After approximately 10 to 15 seconds, if a fault code is present, the red brake warning lamp will begin to flash. Count the number of flashes. This will represent the fault code number.



Fig. 24 — While holding the brake pedal down, if a fault code is present, the warning lamp will begin to flash.

If the lamp does not come on at all, crank the engine to perform a brake warning lamp bulb check. If the lamp illuminates, no ABS codes are present.

If the brake warning lamp stays on continuously during the diagnostic procedure, see the symptom diagnostic chart as directed by the ABS functional check in the service manual.

Then, to exit the diagnostic mode, release the brake pedal.

Incidentally, if the brake is held down, the ABS code will repeat in about 10 seconds.

The code will be stored in memory as long as the ignition is left "ON."

Diagnosis of the ABS consists of three basic diagnostic steps outlined in the service manual to help detect and correct ABS problems (Figure 25).



Fig. 25 — There is a special service manual for the ABS system.

First, the visual inspection consists of checking easily accessed components that could cause an antilock system malfunction.

This inspection may quickly identify the cause of a malfunction and eliminate further diagnostic checks (Figure 26).

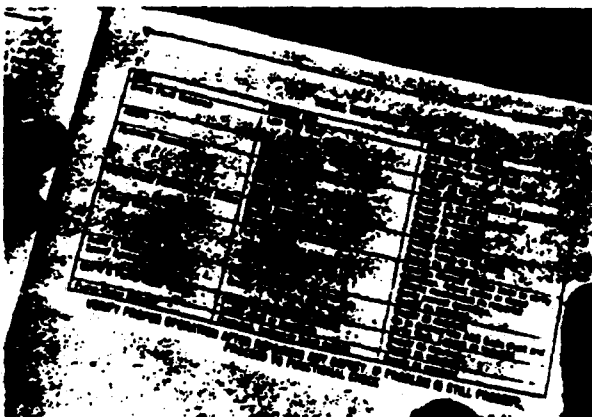


Fig. 26 — Basic diagnostic procedures begin with a visual inspection.

Second, if the ABS condition is not resolved with a visual inspection, the functional check should then be performed (Figure 27).

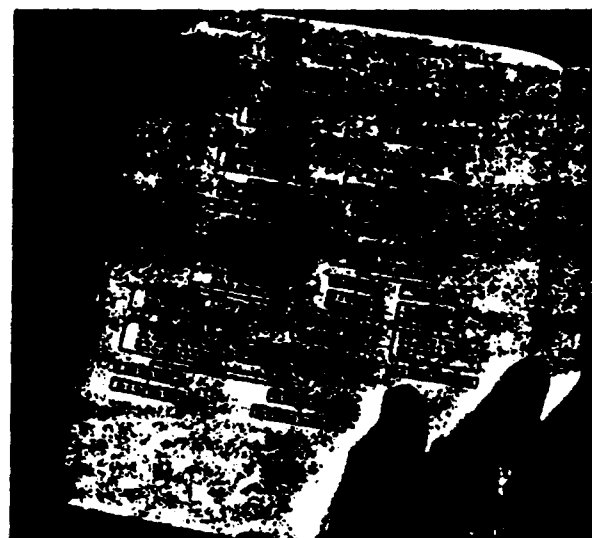


Fig. 27 — The functional check gives you a path to track the problem down.

The functional check may lead to several different test methods and various types of diagnostic charts, which leads us to step-three additional tests.

This step contains many detailed charts and tables to assist you in pinpointing the cause of a malfunction.

During step three, you may need to depressurize the hydraulic system to conduct diagnostic procedures.

As mentioned, the pump/motor assembly will keep the hydraulic accumulator charged to a high pressure of 2,100 to 2,600 psi any time the ignition is in the "ON" position.

Unless otherwise specified, the hydraulic system must be depressurized before disassembling any portion or loosening any of the hydraulic lines. The procedure to depressurize the system is as follows:

With the ignition "OFF," or the sensor block connector disconnected or battery disconnected, pump the brake pedal a minimum of 25 times. A noticeable change in pedal feel will occur when the accumulator is discharged.

When a definite increase in pedal effort is felt, pump the pedal a few additional times. This will remove a hydraulic pressure from the system.

There are two special service tools required for the antilock brake system: a high-pressure gauge and adapter Miller special tool 6163 and the Miller special tool 6100 (Figure 28).

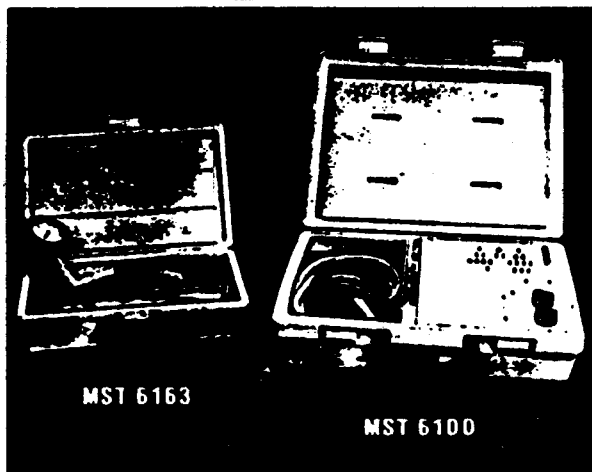


Fig. 28 — There are two Miller special tools required for the antilock brake system.

MST 6163 is used to measure hydraulic pressure in the accumulator as required by specific procedures outlined in the service manual.

The tool consists of a high-pressure gauge, hose and special adapter.



Fig. 29 — The bleed screw is very accessible.

Before connecting the gauge, make sure the ignition is turned "OFF" or you have disconnected the battery, and that the accumulator is depressurized.

Then remove the bleed screw on the right side of the hydraulic assembly (Figure 29).

Install the MST 6163 to the adapter and tighten until snug. Be careful not to overtighten, and make sure the adapter block is free to rotate (Figure 30).

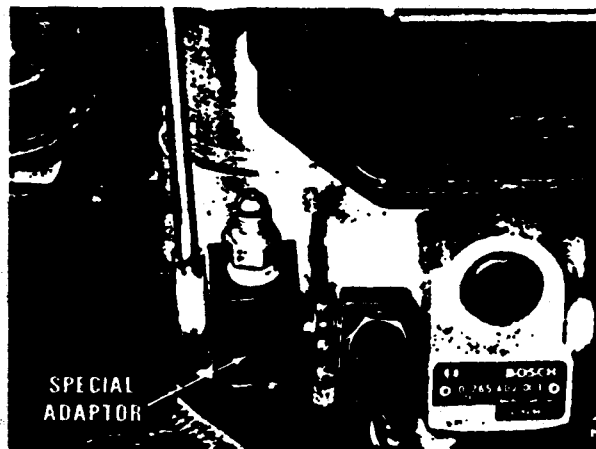


Fig. 30 — Take great care to not overtighten.

Next, attach the pressure hose to the adapter and tighten (Figure 31).

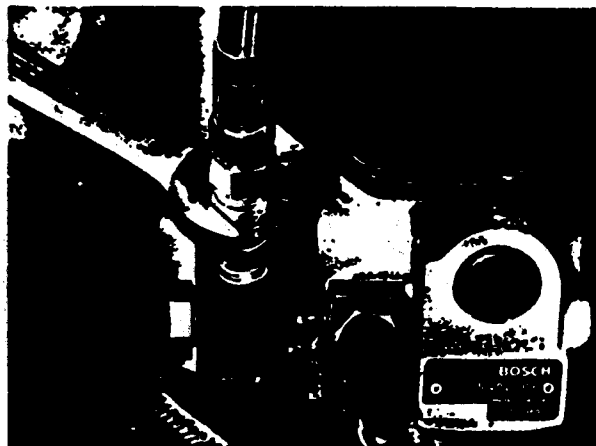


Fig. 31 — Attach the adapter.

When disconnecting the pressure gauge, always be sure to depressurize the accumulator. Now we can examine the other tester we mentioned.

The MST 6100 tester will perform diagnostic functions according to the service manual as required.

This tester consists of two distinct units housed in the same case (Figure 32).

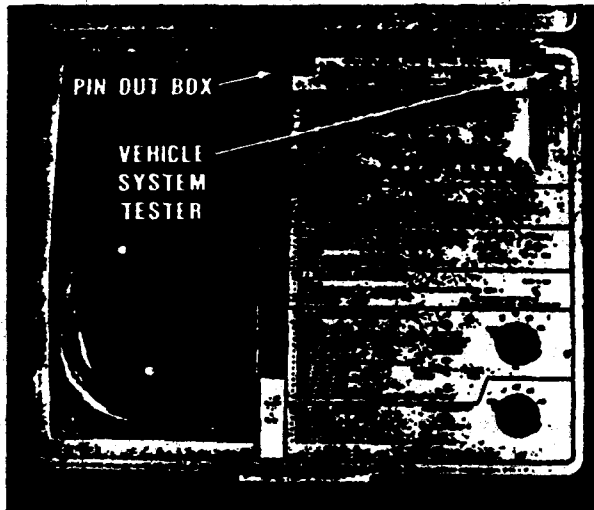


Fig. 32 — The MST 6100 is a two-in-one tester.

A single cable is provided to hook up either the pin-out box or the vehicle system tester.

To connect this tester, make sure you have turned the ignition "OFF."



Fig. 33 — The connector is easily removed from the ABCM.

Then, open the vehicle's trunk to gain access to the ABCM connector and connect the test harness (Figure 33).

Connect the small end of the tester harness to either the pin-out box or the vehicle system connector.

The pin-out box provides access to the individual vehicle harness electrical terminals at the ABCM connector. This is for the purpose of making electrical measurements using a volt-ohmmeter.

Measurements should only be made when instructed to do so in the diagnostic charts.

The vehicle system tester performs static and dynamic tests of the ABS for diagnostic purposes.

The tester harness must be plugged into the vehicle system tester connector on the upper right corner of the tester panel.

These tests should only be performed when instructed to do so by the system diagnostic charts. Now, let's discuss how a failure might be diagnosed.

Let's say you receive a customer complaint of a red brake warning lamp "ON."

First, conduct a visual inspection as outlined in the service manual.

If this doesn't uncover any problem, conduct the ABS functional check in your service manual.

By working your way through this chart, you'll be guided in the proper direction.

Let's say the chart has led us to checking for the presence of ABS codes.

Checking for light flashes by depressing the brake pedal as described earlier, and counting them, you, in this instance, receive a fault code 13.

The box at the bottom of the ABS functional check leads to the ABS fault code table (Figure 34).

By tracing the description of the problem associated with fault code number 13, we are able to deduce that there is a problem related to excessive displacement or circuit failure. And more information can be found on pages 2-21.

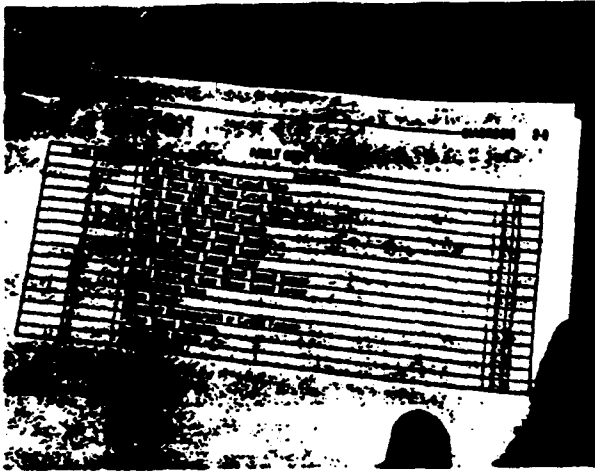


Fig. 34 — The fault code table gives a description of the problem and a page number where information can be found.

Then, turning to the flowchart in the service manual on that page (Figure 35) will lead you to install the MST 6100 vehicle system tester and perform switch plausibility test 2.

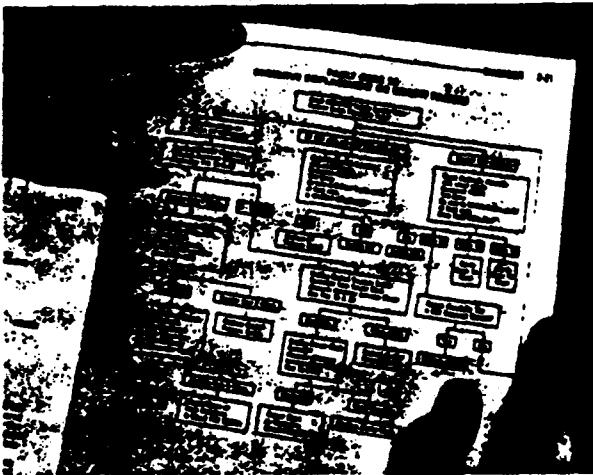


Fig. 35 — This flowchart demonstrates how easy it is to use this diagnostic system.

In this example, we see that the S1 LED goes out after S2 B. Go through and conduct the series of procedures outlined in the next box below.

For example, bleed the hydraulic assembly and wheel circuits, reconnect the ABCM, take a test drive, and be sure you fully depress the brake pedal.

If the fault code is still present, replace the S1 pressure switch. If not, the system is OK and you can stop here.

Now, to get an idea of how the tester's pin-out box works, let's read about another example.

You receive a complaint of a yellow light "ON."

First, conduct a visual inspection as outlined in the service manual. If this doesn't uncover any problems, conduct the functional check as seen on pages 2-8. After we have worked our way through the functional check, we will check for the presence of ABS codes.

By counting the brake warning light flashes while depressing the brake pedal, we will arrive at fault code 5. The ABS fault code table tells us that this is a left front wheel-speed sensor. By using the flowchart on pages 2-13, the first box directs us to install the MST 6100 pin-out box and measure resistance between pins 4 and 5.

If the reading is outside 800 to 1,800 ohms, follow the service manual's procedures and disconnect the sensor connector and measure resistance between connector pins on the sensor side. If the measurement is still outside 800 to 1,800 ohms, replace the wheel-speed sensor (Figure 36).



Fig. 36 — This situation would require replacement of the wheel-speed sensor.

Well, I'm sure you found this Master Tech Reference Book interesting and informative. And always remember that by using the service manual and vehicle diagnostic equipment available you should be able to diagnose problems related to the antilock brake system and continue to keep your customers stopping on a dime.

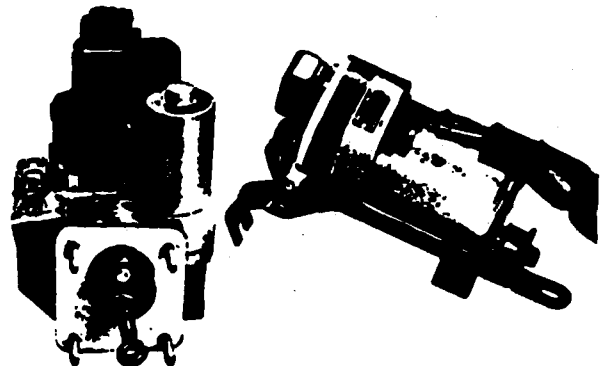
THE SERVICE PROFESSIONALS

QUIZ

INSTRUCTIONS: Questions one through ten are multiple-choice questions. Circle the letter in front of the answer you think is correct. For example, if your choice in number one is C, put a circle around it like this C. Be sure to write your name in the space provided. After completing the quiz, turn it in to your meeting leader.

NOTE: DO NOT TEAR OFF THIS PAGE

1. The primary function of the ABCM is to _____.
 - A. detect wheel locking tendencies
 - B. control the brake system while in antilock mode
 - C. monitor the system for proper operation
 - D. control the display of the ABS fault codes while in the diagnostic mode
 - E. All of the above
2. A total of _____ fault codes may be stored in the ABCM and displayed for diagnostic purposes.
 - A. 14
 - B. 15
 - C. 16
3. The ABCM continues to control pressure in each individual hydraulic circuit until a locking tendency is no longer present or when the vehicle speed drops to _____ miles per hour or below.
 - A. two to three
 - B. five to ten
 - C. ten to fifteen
4. The over voltage protection relay is located _____.
 - A. behind a shield in the trunk
 - B. in the kick panel on the passenger side
 - C. on the left inner fender shield
5. How many self-checks does the antilock system perform every time the vehicle is started?
 - A. Two.
 - B. Four.
 - C. Six.
6. When an antilock vehicle is driven and reaches a speed of approximately three miles per hour, the system performs a functional test called _____.
 - A. Auto-Test
 - B. ABST
 - C. BITE
7. Which of the methods listed below will notify the driver of an antilock system malfunction?
 - A. Red brake warning lamp.
 - B. Amber antilock warning lamp.
 - C. Audible signal in the passenger compartment.
 - D. A and B.
8. The ABS system self-diagnostic capability allows 16 fault codes to be displayed individually under various conditions. How many fault codes can be stored at one time?
 - A. 2
 - B. 1
 - C. 16
9. Which of the problems listed below is of a mechanical nature and technicians should refer to the brake section of the service manual?
 - A. Vehicle vibration during normal braking.
 - B. Brake pull.
 - C. Parking brake problems.
 - D. All of the above.
10. The pump/motor will recharge the accumulator until it reaches an approximate pressure of _____ psi.
 - A. 1,000 to 1,300
 - B. 1,300 to 2,000
 - C. 2,100 to 2,600



NAME: _____

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NQ 4 April 1997 Reference Book

Ram Pickup Brake Systems Update



CustomerOne's



 CHRYSLER
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Ram Pickup Brake Systems Update

As brake systems are becoming more and more advanced, so is the technology behind them. For this reason, it's important that service technicians remain familiar with the different operating characteristics and components of the various brake systems available on Chrysler vehicles.

Welcome to Master Tech. This month, we're going to talk about updates to the brake systems used on Ram pickups. We'll begin by looking at the new hydraulic brake booster on trucks with Cummins Diesel engines, and as a running change in 1997, on 3500 Series trucks with gasoline engines.

Then we'll go over a TSB that could explain a condition you may have already seen in your service center.

Finally, we'll look at a new feature on some Ram trucks that was released in the mid-1997 model year — a height-sensing proportioning valve that controls the amount of hydraulic fluid routed to the rear brakes according to the vehicle load conditions.

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THROUGH TECHNICIAN
CERTIFICATION

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<i>Height-Sensing Proportioning Valve</i>	11

✓✓✓✓✓ VIDEO REVIEW QUESTIONS

Which of the following components is used only during reserve system operation?

- A. Travel limiter.
- B. Spool valve.
- C. Accumulator valve.
- D. Lever.

True or False? When checking the operation of the accumulator, to discharge it, apply the brakes, and turn the steering wheel from lock to lock.

- A. True.
- B. False.

Under normal driving conditions, how often will the front brake linings need to be replaced before the rear brake linings require replacement?

- A. One time.
- B. Two times.
- C. Four times.
- D. Six times.

What is the function of the cam in the height-sensing proportioning valve?

- A. Limits plunger travel.
- B. Controls the operation of the lever.
- C. Limits brake pressure to the rear wheels.
- D. None of the above.

Hydraulic Brake Booster Components and Operation

As you know, the purpose of power brakes is to provide the vehicle with improved braking ability while reducing the amount of pedal effort. Many vehicles use a power brake vacuum booster, which utilizes engine vacuum to apply the hydraulic brake system.

Because Diesel engines don't provide the necessary vacuum, an engine-driven vacuum pump has been used in the past to supply vacuum for power assist. Like 1996 models, on 1997 models, the vacuum pump and power steering pump are still attached to one another and the vacuum pump still provides a vacuum source for items such as the HVAC system (Fig. 1).

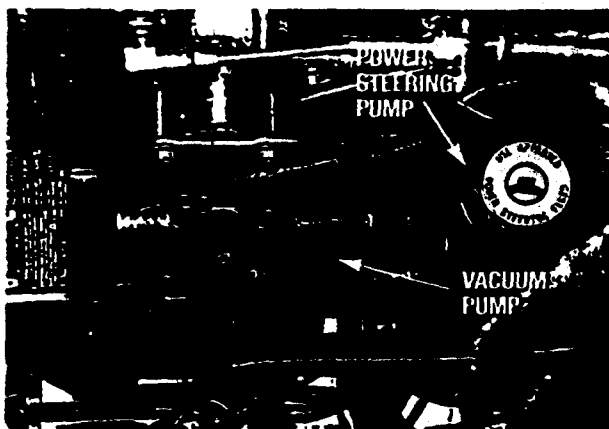


Figure 1 – On 1997 models, the vacuum pump is still mounted to the steering pump and still provides a vacuum source for items such as the HVAC system.

The new hydraulic brake booster uses hydraulic pressure from the power steering pump for power assist (Fig. 2). Mounted on the front cowl panel, the hydraulic brake booster assists the master cylinder in its job of supplying the brakes with pressure.



Figure 2 – The hydraulic brake booster uses hydraulic pressure from the power steering pump for power assist.

To get a better understanding of how the hydraulic brake booster operates, let's look at some booster components. When the brake pedal is pressed, the attached pedal rod transfers braking power from the brake pedal to the input rod located in the hydraulic brake booster. In turn, the input rod moves a lever. The lever works in combination with a spool valve and boost piston to provide hydraulic assist (Fig. 3).

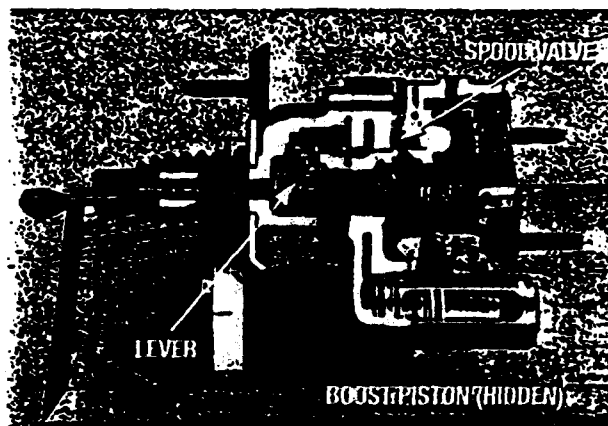


Figure 3 – The lever works in combination with a spool valve and boost piston to provide hydraulic assist.

As the input rod moves forward, it causes the spool valve to move creating a path for hydraulic fluid supplied by the power steering pump to enter the boost cavity. As it does so, hydraulic pressure forces the boost piston forward, which in turn pushes the output rod forward. The output rod provides the link between the boost piston and master cylinder.

Primary and secondary pistons in the master cylinder provide brake fluid pressure to the brakes, as in a conventional brake system.

The hydraulic brake booster uses fluid supply and return lines in order to route the fluid throughout the system (Fig. 4). First, a line routed from the power steering pump to the hydraulic brake booster provides the booster with pump pressure. A second line routed from the hydraulic brake booster to the power steering gear provides the steering gear with the pressure that it requires. Low-pressure return lines at the power steering gear and the hydraulic brake booster route fluid back to the power steering pump reservoir.



Figure 4 – The hydraulic brake booster uses fluid supply and return lines to route the fluid throughout the system.

If for any reason power steering system pressure is not available, the hydraulic brake booster has a backup system. An accumulator holds reserve system pressure in order to provide power assist in the event of pump failure, a broken belt, vehicle shut-off, etc. (Fig. 5) Mounted to the hydraulic brake booster, the nitrogen-charged accumulator allows two to three reserve stops.

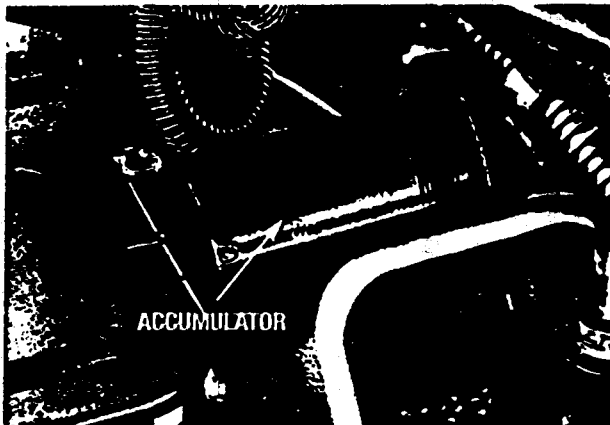


Figure 5 – An accumulator holds reserve system pressure in order to provide power assist in the event of pump failure, a broken belt, vehicle shut-off, etc.

During reserve system operation, an accumulator valve in the hydraulic brake booster releases the fluid from the accumulator into the boost cavity for the power assist.

After the accumulator has been depleted, the system provides manual braking. A travel limiter in the hydraulic brake booster at the end of the input rod is used at this time. Since no system pressure is available, when the brake pedal is pressed, fluid trapped between the travel limiter and boost piston acts as a mechanical connection which operates the boost piston (Fig. 6).

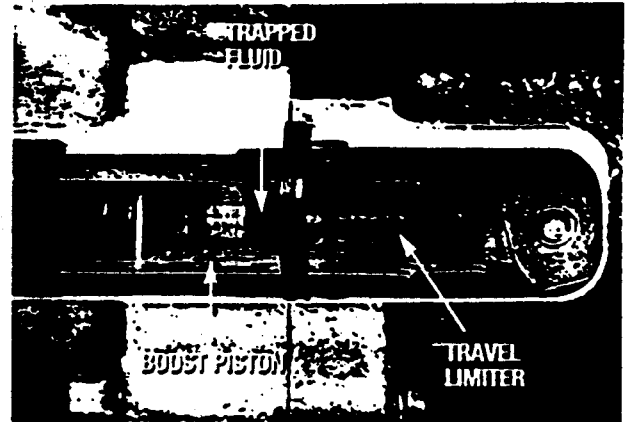


Figure 6 – During manual operation, when the brake pedal is pressed, fluid trapped between the travel limiter and boost piston acts as a mechanical connection which operates the boost piston.

During normal operation, because hydraulic pressure is available, the input rod travel is less than the output rod travel. At this time, minimal pedal effort is needed. During manual operation however, because of the lack of hydraulic pressure in the system, the pedal ratio changes. The input rod travel now matches the output rod travel, and the driver will notice the additional pedal effort required.

The hydraulic brake booster is paired with a dual compensating port master cylinder. Mounted to the hydraulic brake booster, the master cylinder is responsible for supplying brake fluid pressure to the brakes. It has a larger fluid reservoir than the master cylinder used on vehicles equipped with a vacuum brake booster (Fig. 7). During service, it's important to remember that the two master cylinders are not interchangeable.

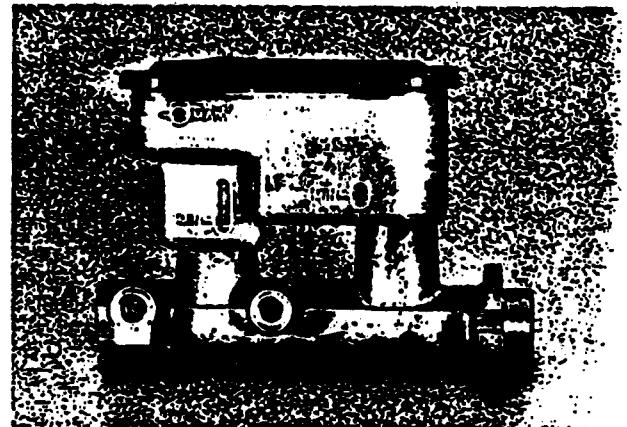


Figure 7 – The master cylinder used on vehicles with the hydraulic brake booster has a larger fluid reservoir than the master cylinder used on vehicles equipped with a vacuum brake booster.

Looking at the power steering pump, you'll notice it's mounted to the back of the vacuum pump. At all times during normal vehicle operation, the power steering pump routes hydraulic pressure through the hydraulic brake booster to the power steering gear (Fig. 8). Only during brake application is the pressure also used by the hydraulic brake booster.

As you'll recall, the lever moves the spool valve to allow hydraulic pressure to enter the boost cavity. At all times, however, the spool valve allows hydraulic pressure to be routed to the power steering gear.



Figure 8 – At all times during normal vehicle operation, the power steering pump routes hydraulic pressure through the hydraulic brake booster to the power steering gear.

T W O Diagnosing and Servicing the Hydraulic Brake Booster

Before you begin to diagnose the hydraulic brake booster, you should be aware that a few characteristic noises are common during booster operation. For example, hissing sounds may be heard from the booster when the brake pedal is applied with a force of 40 pounds or more, which exceeds the normal pedal effort. Caused by the movement of fluid within the booster, the hissing will be more noticeable if the vehicle is not moving, and may increase as brake pedal pressure increases.

Also, releasing the brake pedal quickly after a force of 50 to 100 pounds of pressure is applied may cause clunk, chatter or clicking sounds to come from the booster. This is caused by the movement of the components inside the booster.

Some basic system checks should be performed before diagnosing the hydraulic brake booster. First, you'll want to check the power steering pump to make sure it's operating properly. This includes checking the power steering fluid level.

When filling the power steering pump reservoir, don't use transmission fluid or brake fluid. Use only MOPAR power steering fluid or equivalent, and be sure not to overfill the reservoir (Fig. 9). As a reminder, cold temperature fluid is available for cold temperature operation.

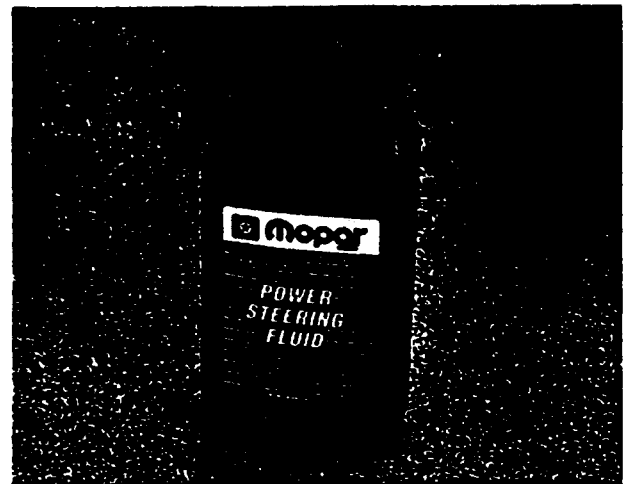


Figure 9 – When filling the power steering pump reservoir, use only MOPAR power steering fluid or equivalent.

After checking the power steering fluid level, check the brake fluid level in the master cylinder reservoir (Fig. 10). While you're checking the brake fluid level, look for signs of contamination such as swollen or deteriorated rubber parts, which could signify the presence of petroleum in the system.

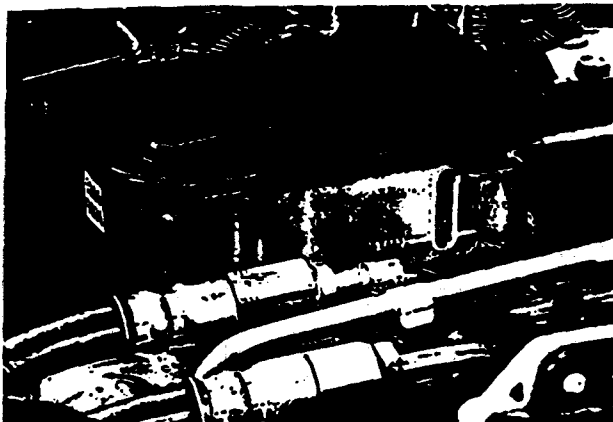


Figure 10 – After checking the power steering fluid level, check the brake fluid level in the master cylinder.

If you suspect the fluid is contaminated, you can test it by putting a small amount into a clear glass jar. If the fluid separates, there is mineral oil or another contaminant in the brake fluid (Fig. 11). If the brake fluid is contaminated, the entire brake system will have to be drained and flushed thoroughly. In addition, many brake system components will have to be replaced, such as the master cylinder, proportioning valve, caliper seals, wheel cylinder seals, ABS hydraulic control unit and all hydraulic hoses.

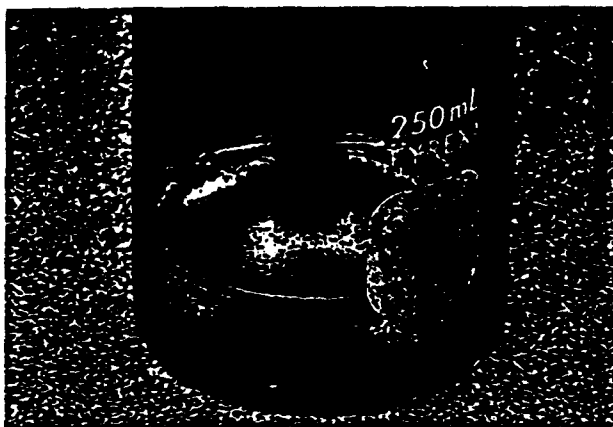


Figure 11 – You can test brake fluid for contamination by putting a small amount into a clear glass jar. If the fluid separates, there is mineral oil or another contaminant present.

Next, inspect the power steering lines and hoses for leaks and restrictions, and, using Power Steering Analyzer Tool kit number 6815, and adapter kit number 6893, which includes tube number 6844, hose number 6905 and adapter number 6826, check the pressure in the power steering pump (Figs. 12 and 13).

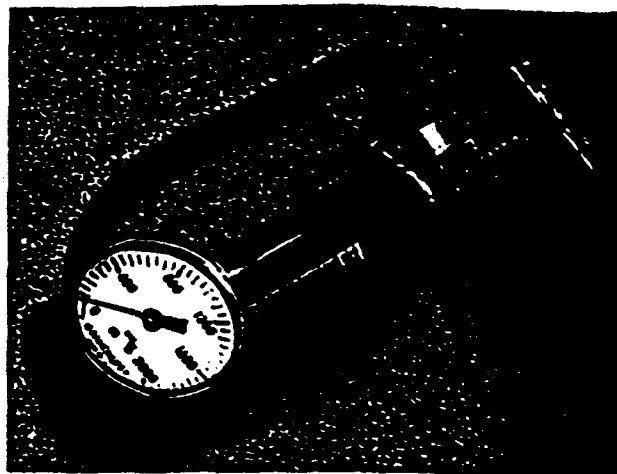


Figure 12 – Power Steering Analyzer Tool number 6815.

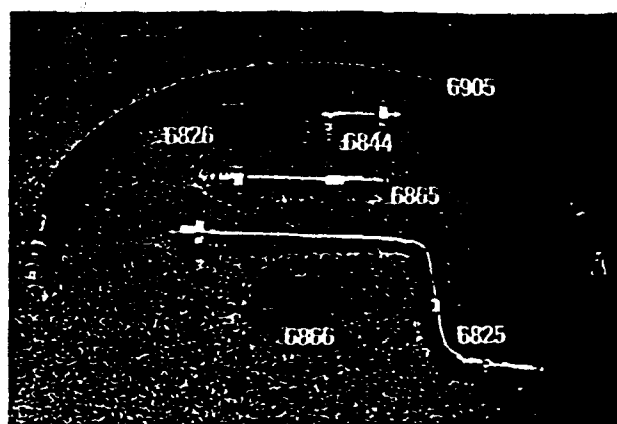


Figure 13 – Adapter Kit number 6893.

Begin by disconnecting the power steering gear high-pressure hose from the hydraulic brake booster. Then connect tube 6844 to the hydraulic brake booster. Next, connect one end of hose 6905 to the power steering analyzer tool, and the other end to tube 6844. Finally, connect adapter 6826 to the gauge test valve end and the power steering gear high-pressure hose (Fig. 14).

Open the test valve completely, start the engine, and let it idle long enough for the power steering fluid to circulate through the pressure gauge, and to get the air out of the fluid.



Figure 14 – Connect adapter number 6826 to the gauge test valve end and the power steering gear high-pressure hose.

When starting a Diesel engine in colder temperatures, after the starter has engaged, hold the accelerator pedal one-quarter of the way to the floor until the engine starts. Also, after the vehicle has started, you should allow it to idle at 1,200 rpm for about three minutes, giving the manifold heaters time to complete the post-heat cycle. For more information about starting Diesel engines, refer to the vehicle Owners Manual.

Now with the engine off, check the power steering fluid level, and add fluid if necessary.

Once again, start the engine and allow it to idle. Then, read the pressure gauge.

At idle, if pressure is high (above 150 psi) there is a blockage in the system downstream of the test equipment (Fig. 15). On the other hand, a low reading indicates either a blockage in the system upstream of the test equipment, or a malfunctioning power steering pump.

You can confirm this by increasing engine speed to 1,200 rpm. In a properly operating system the flow will increase.



Figure 15 – The pressure gauge can indicate if there is a blockage in the system.

To check maximum pump pressure output, close the valve on the pressure gauge completely three times, and record the highest pressure indicated each time (Fig. 16). It's important that you don't leave the valve closed for longer than three seconds at a time, or the pump can be damaged. Once you have recorded your readings, refer to the updated pump specification chart in the Ram Truck Service Manual. Also, if all three pressure readings aren't within 50 psi of each other, the pump will need to be replaced.

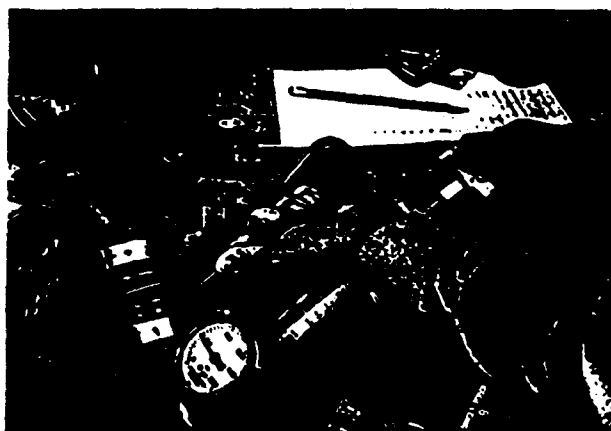


Figure 16 – To check maximum pump pressure output, close the valve on the pressure gauge completely three times and record the highest pressure indicated each time...

Finally, with the valve open and the engine running, compare three pressure readings when the steering wheel is in the extreme left and extreme right positions. Be careful not to force the pump to operate against the stops for more than two to three seconds, because pump damage could result. Readings at the highest output pressure should be the same, and again within specifications. If the highest output pressures are not within 50 psi of each other, there is an internal leak in the gear that will need to be repaired.

Once you're certain the power steering pump is operating properly, you can continue your diagnosis by checking the operation of the hydraulic brake booster.

First, with the engine off, press the brake pedal several times to discharge the accumulator. When the accumulator is depleted, the brake pedal should feel hard, and there will be no brake assist. Then using about 40 pounds of force, press the brake pedal and start the engine. If the booster is receiving pressure, the brake pedal should drop and then push back against your foot.

Next, you'll want to make sure the accumulator is holding a charge. To do this, once again discharge the accumulator by pressing the brake pedal several times. Then inspect the accumulator. If it wobbles or turns, it has lost a gas charge and will need to be replaced (Fig. 17). Since the accumulator and hydraulic brake booster are an assembly, the booster must be replaced.



Figure 17 – To make sure the accumulator is holding a charge, first discharge the accumulator by pressing the brake pedal several times. Then inspect it. If it wobbles or turns, it has lost a gas charge and will need to be replaced.

To check if the system is holding a charge, first make sure the accumulator is charged by starting the engine, applying the brakes, and turning the steering wheel from lock to lock. Then turn off the engine and let the vehicle stand for an hour. If the system is holding a charge after an hour has elapsed, there should be at least two power-assisted brake applications with the engine off. If the system isn't retaining a charge, the hydraulic brake booster must be replaced.

Next, you'll want to make sure that there are no leaks in the system. Start by checking for leaks around the accumulator, and the accumulator seal on the booster. Other seals to check include those located at the fluid supply and return lines, input rod, at the interface between the booster and master cylinder, at the spool valve, and housing. If any leaks are present, the booster must be replaced (Fig. 18).



Figure 18 – Check all seal locations on the hydraulic brake booster for leaks. If any leaks are present, the booster must be replaced.

Anytime you're replacing the hydraulic brake booster, be sure to first discharge the accumulator by pressing the brake pedal several times, and remember that the accumulator contains high-pressure gas. When carrying the hydraulic booster, don't hold it by the accumulator, and take care not to drop it on the accumulator (Fig. 19).



Figure 19 – When carrying the hydraulic brake booster, don't hold it by the accumulator, and take care not to drop it on the accumulator.

Also, before you install the booster, be sure the snap ring that holds the accumulator in place is properly seated. And inspect the O-rings on the pressure line fittings to be sure they are in good condition (Fig. 20). If necessary, replace any O-rings that are worn.



Figure 20 – Inspect the O-rings on the pressure line fittings.

After installing the hydraulic brake booster, check the power steering fluid level again.

After the hydraulic brake booster has been installed, you'll need to fill and bleed both the brake and hydraulic boost systems. After bleeding the brake system, bleed

the hydraulic boost system by first disconnecting the fuel shutdown relay, then cranking the engine for a few seconds. Check the power steering pump reservoir again, and add fluid if necessary.

Next, re-connect the fuel shutdown relay and start the engine. Then turn the steering wheel from lock to lock twice, and stop the engine. Discharge the accumulator as before, by pressing the brake pedal several times. And again, start the engine and turn the steering wheel from lock to lock twice. Stop the engine, and once again check fluid level and add fluid if needed.

T H R E E Brake System-Related Technical Service Bulletin

As you know, it's especially important to correct the root cause of a customer complaint. If a customer has to repeatedly return a vehicle with the same condition, it could result in a loss of faith, and you could eventually lose their business. That's why when Chrysler becomes aware of a repair for a recurring condition, they make you aware of it through Technical Service Bulletins, or TSBs.

In fact, one TSB covers the subject of premature brake lining wear, which could relate to a condition that you may have already seen in your service center. Titled "Accelerated Brake Lining Wear, Front Versus Rear," this TSB addresses a condition seen on some Ram pickups. TSB number 05-02-96, Revision A, applies to all 3500 Series Ram pickups and 2500 Series 8,800-pound Gross Vehicle Weight (GVW) Ram pickups — all built before August 5, 1996 (Fig. 21).

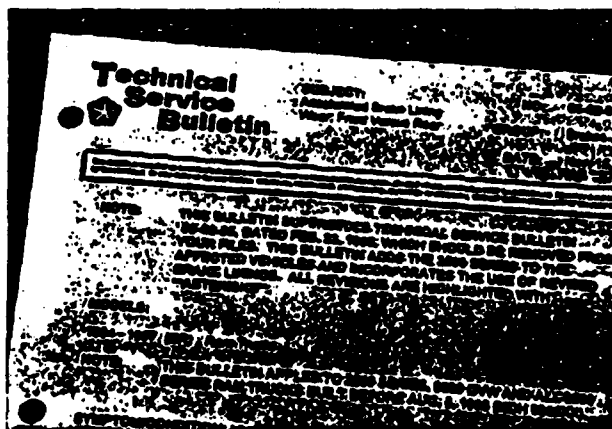


Figure 21 – TSB number 05-02-96, Revision A, applies to all 3500 Series Ram pickups and 2,500 Series 8,800-pound Gross Vehicle Weight Ram pickups — all built before August 5, 1996.

Ordinarily, the front brake linings will need to be replaced twice before the rear brake linings need replacing. An indication that the vehicle is experiencing accelerated wear is that the front linings are being replaced four to six times before the rear linings require replacement.

A few different repair procedures will need to be performed, depending on the vehicle and the driving conditions. You'll need to do a little research to determine if the vehicle you're working on meets the criteria. The first step is to review the service history to determine if the vehicle is experiencing accelerated front brake lining wear.

Next, you'll want to review the vehicle history by checking the date of production. If the vehicle is a 2500 Series with a GVW rating of 8,800 pounds, you'll need to know if the vehicle is operated continuously near 75 percent or greater of the GVW rating.

Then, visually inspect both the front brake and rear brake components for signs of abnormal wear or mis-assembly of components. If the front brake linings are evenly worn and the rear shoes are lightly worn, the TSB specifies several procedures according to truck model.

The repairs involve replacing the rear wheel cylinders on all 2500 Series, 8,800-pound GVW trucks that meet the load criteria (Fig. 22). In addition, 2500 Series, 8,800-pound GVW, 4 x 4 models that meet the load criteria need to have the front brake linings replaced. All 3500 Series trucks need to have both the front and rear brake linings replaced along with the hold-down springs. Finally, a soon-to-be-released TSB also includes replacing front brake linings on 2500 Series, 7,500- and 8,800-pound GVW 4 x 2 models built before April 7, 1997.



Figure 22 – On 2500 Series, 8,800-pound GVW trucks that meet the load criteria, if the front brake linings are evenly worn and the rear shoes are lightly worn, the rear wheel cylinders will have to be replaced.

Trucks built after August 5, 1996 are already equipped with the brake linings described in the TSB.

REAR WHEEL CYLINDER REPLACEMENT—2500 SERIES PICKUPS

To replace the rear wheel cylinders on 2500 Series trucks, after the brake line is disconnected from the wheel cylinder, lift the adjuster lever away from the adjuster screw and turn the adjuster screw star wheel until the screw is fully retracted.

Then remove the necessary brake components in order to access the wheel cylinder, and remove the wheel cylinder attaching screws and wheel cylinder from the support plate.

Before installing the new wheel cylinder on the vehicle, apply a thin coat of Mopar Silicone Sealer to the mounting surface of the support plate (Fig. 23). Then install the new wheel cylinder on the support plate.



Figure 23 – Before installing the new wheel cylinder, apply Mopar Silicone Sealer to the mounting surface of the support plate.

Once the brake components have been installed, adjust the brake-shoe-to-brake-drum clearance using a brake gauge, as described in the 1997 Ram Truck Service Manual (Fig. 24).

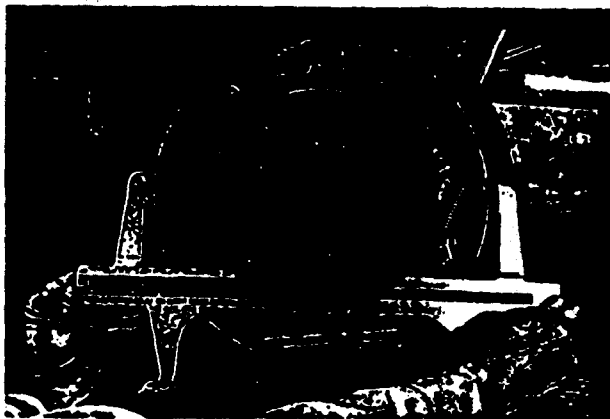


Figure 24 – Once the brake components have been installed, use a brake gauge to adjust the brake-shoe-to-brake-drum clearance.

FRONT BRAKE LINING REPLACEMENT — 2500 SERIES, 8,800-GVW 4x4s AND ALL 3500 SERIES PICKUPS

On 2500 Series, 8,800-pound GVW 4 x 4s and all 3500 Series pickups, the front brake linings must be replaced with newer, more durable linings (Fig. 25).



Figure 25 — On 2500 Series, 8,800-pound GVW 4 x 4s and all 3500 Series pickups, the front brake linings must be replaced with newer, more durable linings.

Once the caliper has been removed from the rotor, remove and discard the inboard brake lining, and the outboard brake lining.

At this point, don't let the brake hose support the caliper, because damage to hose and fitting joints could result. Instead, use a wire to secure the caliper to either a chassis or a suspension component (Fig. 26). With a wire brush, clean the caliper and steering knuckle slide surfaces. Then lubricate the caliper mounting bolt and the interior of the bushing with silicone grease (Fig. 27).

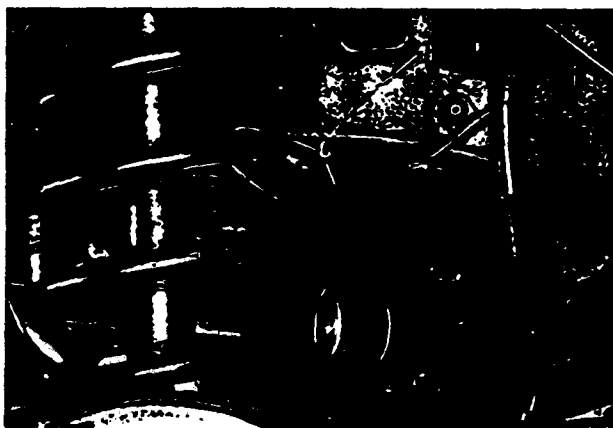


Figure 26 — Don't let the brake hose support the caliper, because damage to hose and fitting joints could result. Instead, use a wire to secure the caliper to either a chassis or a suspension component.

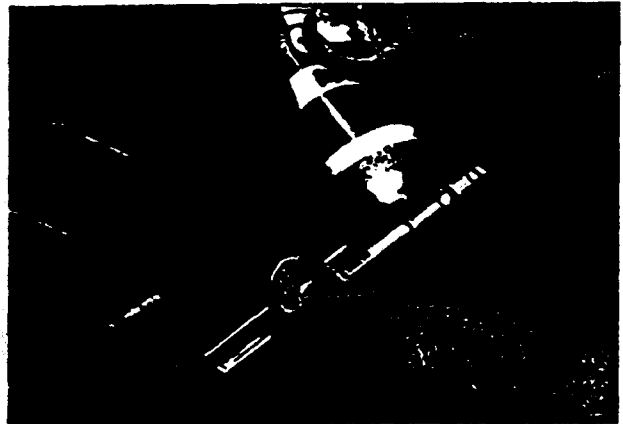


Figure 27 — Be sure to lubricate the caliper mounting bolt.

When installing the new inboard lining, make sure the spring clip fits into the piston and is not caught between the piston and the shoe plate.

On the outboard lining, make sure the ends of the retaining spring seat in the dimples on the outside of the caliper.

After the new brake linings have been installed, install the caliper over the rotor, making sure the caliper is seated flush on the mounting arm (Fig. 28).



Figure 28 — After the new brake linings have been installed, install the caliper over the rotor, making sure the caliper is seated flush on the mounting arm.

When you've finished and lowered the vehicle, pump the brake pedal to reset the caliper pistons and brake linings. Failure to do this will result in a lack of braking power.

As always, when you're finished, check the brake fluid level and add Mopar Dot 3 Brake Fluid, or equivalent, as needed.

REAR-BRAKE SHOE REPLACEMENT — 3500 SERIES PICKUPS

On 3500 Series Ram pickups, in addition to the front brake linings, it will be necessary to replace the rear brake shoes (Fig. 29). When replacing the rear shoes, there are a few things you should remember. First, if at any point during brake shoe removal you notice a leak, you'll need to service the rear wheel cylinder or rear axle seal before continuing.

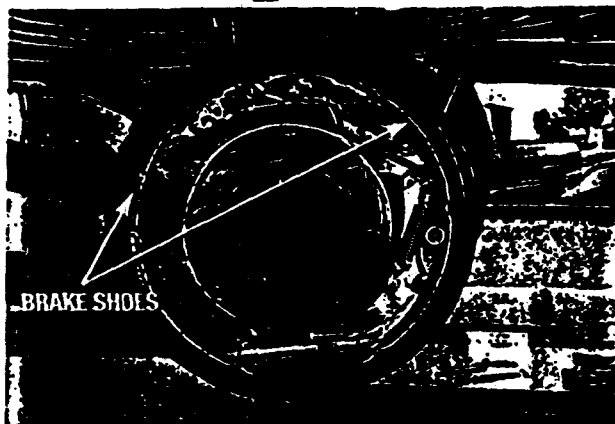


Figure 29 — On 3500 Series Ram pickups, in addition to the front brake linings, it will be necessary to replace the rear brake shoes.

During the procedure, when removing the adjuster lever assembly, it isn't necessary to disassemble it unless components are worn or damaged. If disassembly is necessary, clamp only the center part of the lever in a vise to avoid damaging the lever flange (Fig. 30).



Figure 30 — If disassembling the adjuster lever assembly, clamp only the center part of the lever in a vise to avoid damaging the lever flange.

During installation, when attaching the parking brake lever to the new secondary brake shoe, a new E-clip or U-clip must be used (Fig. 31). And you must use new hold-down springs, pins and retainers, which are contained in a package, when installing the primary and secondary brake shoes.

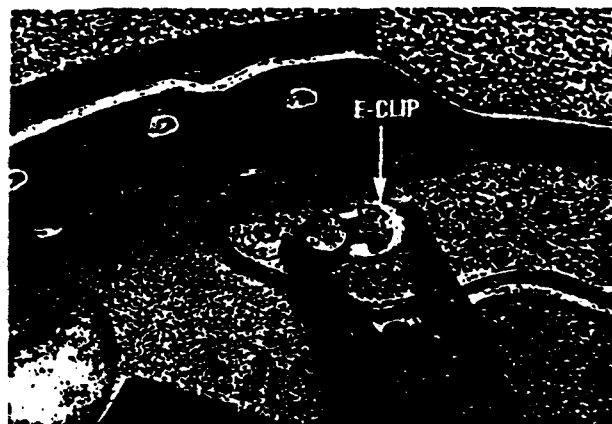


Figure 31 — When attaching the parking brake lever to the new secondary brake shoe, a new E-clip or U-clip must be used.

When installing the adjuster screws, be sure they don't get intermixed, because the driver-side adjuster screw has right-hand threads, while the passenger side has left-hand threads (Fig. 32).

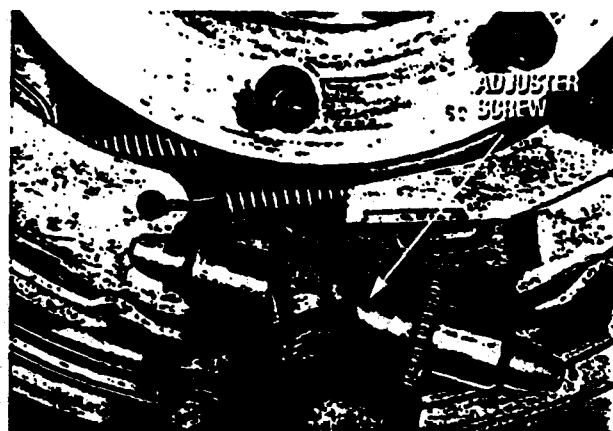


Figure 32 — Don't intermix the adjuster screws, because the driver-side adjuster screw has right-hand threads, while the passenger-side has left-hand threads.

And as before, brake-shoe-to-brake-drum clearance must be adjusted using a brake gauge.

For complete information regarding rear brake shoe replacement, follow the instructions included in TSB 05-02-96, Revision A, using any new part numbers as specified.

After completing the repair, be sure to advise customers that, as brake wear occurs, in order to maintain the rear brake adjustment, the truck needs to be driven in reverse and brought to a complete stop using the brakes.

FOUR Height-Sensing Proportioning Valve

As a running change in 1997, 2500 Series Ram pickup 4 x 4s having a GVW rating of 8,800 pounds have an additional feature — a height-sensing proportioning valve. Mounted at the left frame rail above the rear axle, the height-sensing proportioning valve allows full brake fluid pressure to the rear when the vehicle is loaded (Fig. 33). The height-sensing proportioning valve still allows proportioning when full pressure is unnecessary at lighter loads.

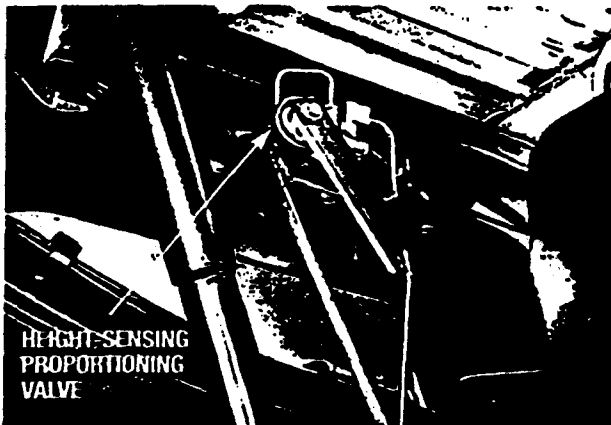


Figure 33 — Mounted at the left frame rail above the rear axle, the height-sensing proportioning valve allows full brake fluid pressure to the rear when the vehicle is loaded.

The height-sensing proportioning valve mates a conventional-type proportioning valve to a height-sensing mechanism and an internal mechanism which regulates brake pressure by limiting valve plunger movement.

The external mechanism consists of a link attached to the axle at its lower end, and to a lever at its upper end (Fig. 34). The lever is connected to a cam, which is the internal device used to limit plunger travel.

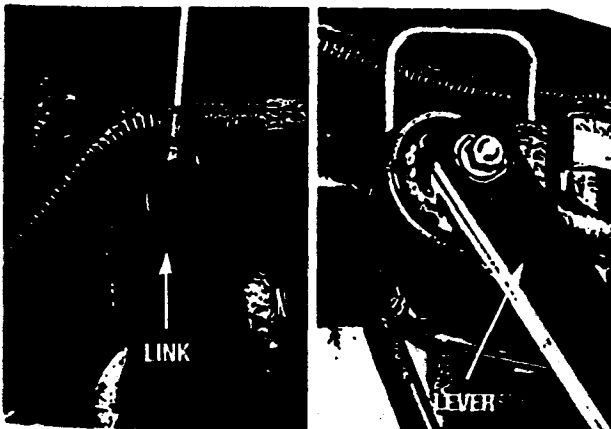


Figure 34 — The external mechanism of the height-sensing proportioning valve consists of a link attached to the axle at its lower end, and to a lever at its upper end.

Under unloaded conditions, the height-sensing proportioning valve limits brake pressure to the rear wheels after a predetermined split point, just as a conventional proportioning valve does. It balances a difference in fluid pressure on each end of the plunger against spring pressure to shuttle the plunger open and closed, thus limiting pressure at the outlet port (Fig. 35).

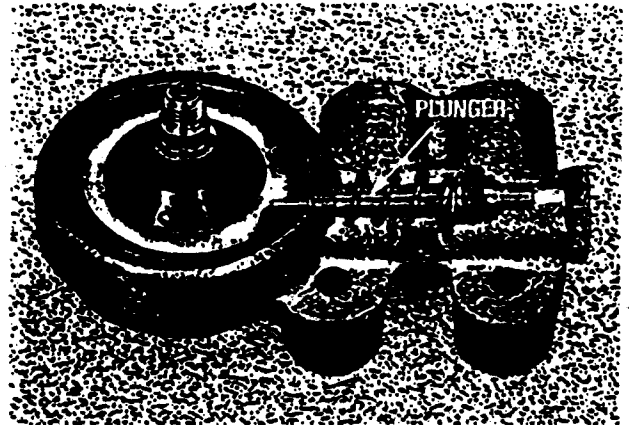


Figure 35 — The height-sensing proportioning valve balances a difference in fluid pressure on each end of the plunger against spring pressure to shuttle the plunger open and closed.

When the truck is loaded, the frame moves down in relation to the axle. As a result, the link on the axle moves the lever upward, rotating the cam internal to the valve. The step on the cam then limits plunger travel and eliminates the plunger's closing against the valve seat (Fig. 36). When the vehicle is fully loaded, the proportioning valve no longer limits pressure to the rear brakes.

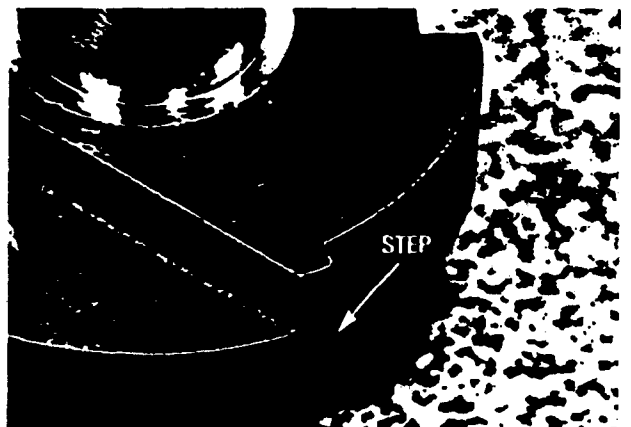


Figure 36 — The step on the cam limits plunger travel and eliminates the plunger's closing against the valve seat.

A torsional clutch spring connected to the cam allows the valve to maintain the mode it's in by allowing the shaft to turn independently of the cam (Fig. 37). As a result, if the truck hits bumps during braking, the valve will not switch out of its initial mode.



Figure 37 – The torsional clutch spring allows the valve to maintain the mode it's in by allowing the shaft to turn independently of the cam.

The height-sensing proportioning valve is pre-adjusted at the factory. If for any reason it needs to be removed, care must be taken in order to maintain the setting mode.

To remove the valve, first remove the link from the lever. Then disconnect the brake lines from the valve. Next, remove the nuts holding the mounting bracket and valve to the frame, and remove the mounting bracket, valve and lever as an assembly.

It's important that you don't remove the lever from the valve (Fig. 38). Removing the lever from the cam will disturb the adjustment, and since it can't be readjusted, the valve would need to be replaced. Also, after reinstalling the valve, the rear brakes will have to be bled.

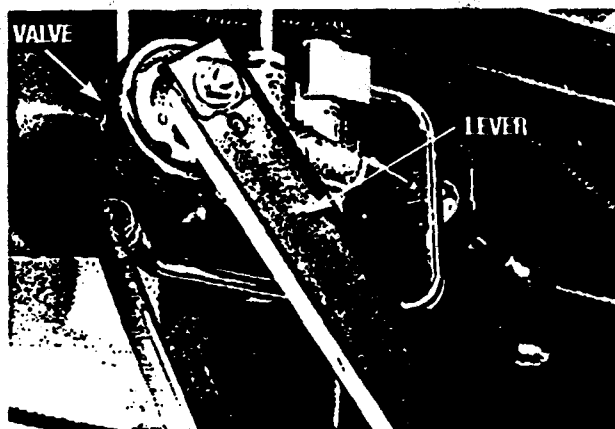


Figure 38 – Do not remove the lever from the valve, as the adjustment will be disturbed.

A couple of differences you may notice on vehicles with the height-sensing proportioning valve are new, larger rear wheel cylinders, as well as a different combination valve (Fig. 39).



Figure 39 – Vehicles equipped with the height-sensing proportioning valve also have larger rear wheel cylinders, and a different combination valve.

Since vehicle height affects the braking action of the proportioning valve, you should inform your customers that adding accessories such as air shocks, load levelers, etc., can cause false readings to the valve.

Before concluding this month's Master Tech, we'd like to take a minute to tell you how you can receive training credit without even leaving your dealership.

You've no doubt heard of the Fundamental Automotive Systems Training, or FAST program. It consists of a 15-CD-i disc library. But did you know that you can receive eight credit hours for individual courses to be applied to the Technical Training Skill Core Curriculum program?

To receive credit, all you have to do is follow the course on the CD-i and pass the final exam with a score of 85 percent or higher. Be sure you record the information before exiting the CDi, because once you exit, the information will be lost. Then, to obtain credit for the course, make a copy of the Certificate of Completion Order Form (which is the last page of the CD-i booklet), and then send the order form to Chrysler, and Chrysler will send you a certificate of completion.

Well, that's it for this month's Master Tech. Watch for us next month when we'll be looking at the various sound systems available on Chrysler vehicles. We'll see you then.

INSTRUCTIONS: Questions one through ten are multiple choice and True or False. Circle the letter in front of the answer you think is correct. Be sure to write your name in the space provided. After completing the quiz, turn it in to your Meeting Leader.

1. *True or False? Vehicles equipped with the hydraulic brake booster no longer have a vacuum pump.*
 - A. True.
 - B. False.
2. *Which of the following is not an internal component of the hydraulic brake booster?*
 - A. Accumulator valve.
 - B. Lever.
 - C. Pedal rod.
 - D. Spool valve.
3. *During manual braking, hydraulic fluid is trapped between the _____ and the boost piston.*
 - A. pedal rod
 - B. input rod
 - C. accumulator valve
 - D. travel limiter
4. *During normal braking operation, which of the following statements is true?*
 - A. Input rod travel is less than output rod travel.
 - B. Input rod travel is more than output rod travel.
 - C. Input rod travel equals output rod travel.
 - D. None of the above.
5. *What is the function of the spool valve in the hydraulic brake booster?*
 - A. During reserve system operation, releases fluid from the accumulator into the boost cavity for power assist.
 - B. Creates a path for hydraulic fluid from the power steering pump to enter the boost cavity.
 - C. During manual operation, traps fluid at the boost piston, acting as a mechanical connection.
 - D. None of the above.
6. *Technician A says that to charge the accumulator with the engine running and brakes applied, you should turn the steering wheel from lock to lock. Technician B says you have to pump the brake pedal several times. Who is correct?*
 - A. Technician A.
 - B. Technician B.
 - C. Both A and B.
 - D. Neither A nor B.
7. *According to TSB 05-02-96, Rev. A, all 3500 Series trucks built before August 5, 1996 will need the _____ replaced.*
 - A. rear-wheel cylinders
 - B. front brake linings only
 - C. rear brake linings only
 - D. hold-down springs
8. *The height-sensing proportioning valve is a feature on which of the following vehicles?*
 - A. All 3500 Series pickups.
 - B. 2500 Series, 8,800-pound GVW 4 x 2 pickups.
 - C. 2500 Series, 8,800-pound GVW 4 x 4 pickups.
 - D. All of the above.
9. *Which of the following components is not a feature of the height-sensing proportioning valve?*
 - A. Cam.
 - B. Travel limiter.
 - C. Plunger.
 - D. Torsional clutch spring.
10. *True or False? Under unloaded conditions, the height-sensing proportioning valve remains inoperative.*
 - A. True.
 - B. False.

Name _____

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